THE FOUNDRY

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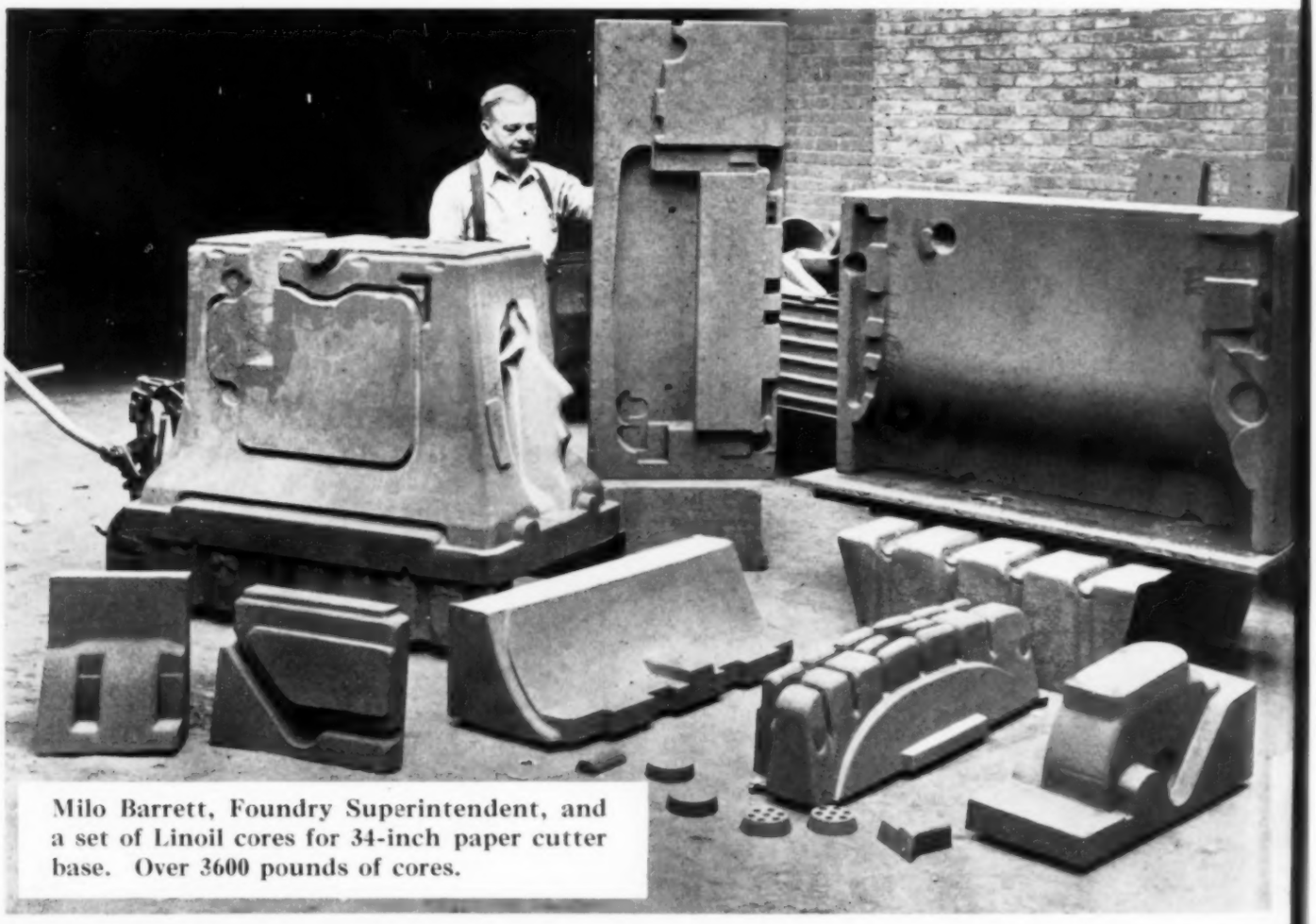
ADVERTISING PAGES REMOVED

The WAY to get on with

DECIDEDLY these are not the days when a foundryman willingly carries any unnecessary burden, and core troubles in this day and age are unnecessary. At least this is the testimony of expert foundrymen who use Linoil. When scores of men of recognized soundness in the industry are willing to stand right up in meeting and tell their fellow craftsmen they believe Linoil is the logical oil to use, sound judgment suggests that you look into its possibilities.

It won't take but a moment to send for the Linoil man Tell him to prove that you can save money and lost motion, and tell him to do it without interfering with the steady flow of the work going through.

Remember UNIFORMITY, remember the smooth work at the bench, remember the oven speed and the center drying, remember the porosity of the cores and the scarcity of core damaged castings, remember the quick cleanout, remember the economy of Linoil.



Milo Barrett, Foundry Superintendent, and a set of Linoil cores for 34-inch paper cutter base. Over 3600 pounds of cores.

EDITORIAL

Regulations Recognize Needs Of Defense Foundries

WHILE the confusion occasioned by application of priority ratings, rationing orders and a multiplicity of other governmental controls continues throughout the foundry industry, there seems to be a distinct possibility that foundries engaged in the production of defense castings soon may find some of the problems of raw materials and equipment procurement less arduous. Hesitation on the part of the government to direct an all out defense effort has diminished almost to the vanishing point. At the same time, the new Supply Priorities and Allocations Board has announced its intention of planning the defense program from this point forward on the basis of accurate and co-ordinated knowledge of both military and civilian requirements.

The accelerated pace with which the problems of industry are being handled by OPM is perhaps the most heartening development of the past few weeks. Early in September, the new Director of Priorities, Donald M. Nelson, cut red tape which had caused a log jam in the Priorities Division during most of the summer, and almost overnight cleaned the decks of all priority requests from industry, many of which had been delayed for a number of weeks. At the same time, the director announced that in the future ordinary applications for preference ratings or mail inquiries will be handled within 48 hours. If these actions and promises continue, there will be no more costly delays in securing action on such applications for preference ratings.

As this is written, pig iron is being distributed to the foundry industry for the first month under General Preference Order M-17, and reports from producers governing distribution of iron in October are being received by the OPM. The section of that organization handling allocations of pig iron for September performed an exceptional piece of work under the most difficult circumstances, and should have the appreciation of both producers and consumers. In October the allocations program should work smoothly in supplying pig iron for defense foundries and eventually this program should provide a tonnage of iron sufficient to meet at least essential nondefense demands for ferrous castings. Scrap still presents a tremendous problem, due in part to the unwillingness of the price control division to recognize the almost impossible situation which has been created by the "ceiling" prices on iron and steel scrap. Allocations through a preference order have been promised, and are reported under consideration, but it is doubtful if such an order will prove effective in solving the problem unless more ways are developed to bring out remote scrap.

As is mentioned elsewhere in this issue, the new Preference Rating Order P-22 covering repairs offers considerable assistance to the foundry industry in obtaining emergency repair parts. By the simple process of stamping the original and all copies of the order for the repair part with this statement—"Purchase Order for Repair or Emergency Inventory-Preference Rating A-10 Under Preference Rating Order P-22"—the foundry is permitted to use an automatic A-10 for the purchase of repairs. Also the new blanket rating, General Preference Order P-31, recently granted the foundry equipment industry for the procurement of materials to produce certain types of foundry equipment will facilitate movement of equipment into foundries. It should be noted that delivery of foundry equipment now is limited to those foundries engaged in defense work, so that the individual foundry must secure an extension of preference rating or make application to the OPM for a preference rating before the equipment manufacturer may start work on the order.

But the difficulties facing non-defense foundries continue. Beyond the organization of the Division of Contract Distribution in the OPM, little progress has been made in assisting those plants not operating on a high percentage of defense work to obtain needed raw materials to remain in business. Unless a way can be found to divert a more equitable proportion of the total pig iron production of this country to the foundry industry, or unless the government forces more extensive subcontracting, many foundries will find it impossible to operate.

In the face of this situation, the government plans to finance a considerable increase in capacity in several divisions of the foundry industry. Such problems as these show all too clearly the lack of sufficient foundry representation in the planning of the war effort. Absence of co-ordinated effort on the part of the industry will be expensive now and may prove more costly later.

Frank G. Steinebach
Editor

Lebanon Steel Foundry DRAMATIZES Castings in Defense

Views depict various features of the parade and gathering of employes and families in the stadium to hear the addresses. Center above shows W. H. Worrilow, president

OVER 3000 men, women and children comprising the employes of the Lebanon Steel Foundry, Lebanon, Pa., and their families attended the second annual outing held by the firm at Hershey Park, Hershey, Pa. on Aug. 23. Feature of the outing was a parade in which approximately 928 employes participated.

Prominent role in the parade was played by a completed M-3 (13½-ton) light tank which was brought especially from the American Car & Foundry Co., Berwick, Pa. It contained cast armor plate, and transmission cases produced in the Lebanon Steel Foundry, and gave those attending an opportunity of viewing their craftsmanship in its final application.

W. H. Worrilow, president of the firm spoke briefly to those assembled stating in part:

"We have just participated in a ceremony that, while outwardly colorful and light hearted, still underneath indicates a grim determination to do our job and do it right. You men are employed in a basic industry without which little can be accomplished. You are descended from Tubalcain of the Bible, or Vulcan, the iron god of the ancients.

"Your lot has been cast in this pleasant Lebanon valley. Today my mind goes back to another Lebanon, the one from which our section gets its name and which has been so prominent in the war news this spring and summer.

It was to that Lebanon, King David and King Solomon went to obtain their arms and ordnance for their armies and navies. King Hiram of that Lebanon appointed Hiram Abith, the wid-

ow's son, to supervise the production of this war material.

"Hiram Abith was the greatest artisan of all time and was recognized as a master foundryman and as followers of his today, we are gathered to do honor to our craft and to the Lebanon Steel Foundry in particular. As in days of old, governments turned to a Lebanon, so today, our government turns to us to defend the cause of righteousness and peace.

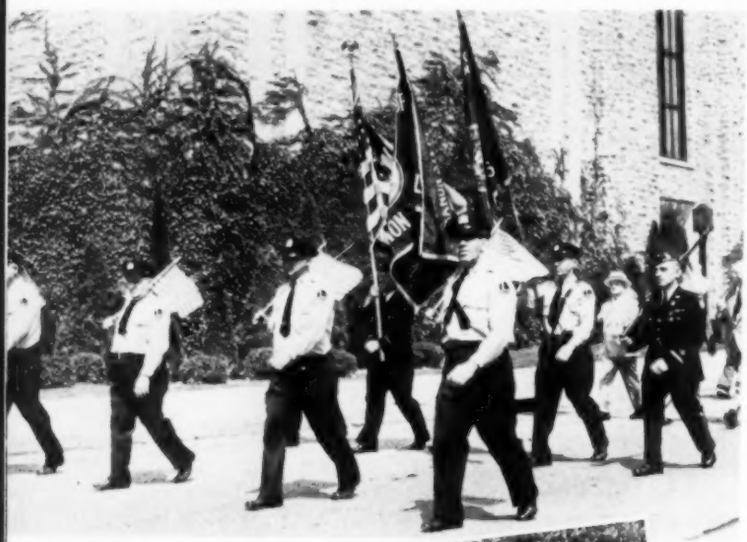
"A great many of the component parts of the light M-3 tank you see before you were made by your hands or those of your fellows and in appreciation of your efforts, the Ordnance Department of the Army has delegated Colonel D. N. Hauseman, Commanding Officer, in charge of ordnance production in the Philadelphia District, to express its thanks for what you have done. Under Colonel Hauseman's able direction, this district has obtained an enviable reputation for quality and speed of production."

Lieutenant Colonel D. N. Hauseman, commanding officer, Philadelphia Ordnance District, in his response spoke as follows:

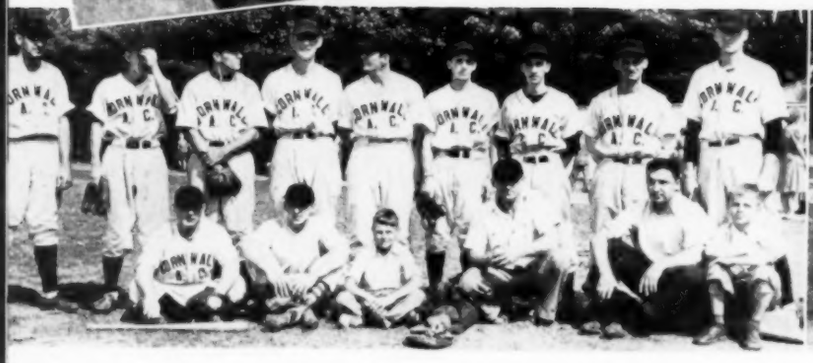
"The product of your workmanship has been reflected here today in the castings built into this light tank M3, which we have all admired in the parade. Truly, it is an indication that your hands and minds have not lost any of the skill and cunning, or knowledge, of your forefathers; and, with all this, Lebanon's reputation has increased.

"I have had 24 years experience in the production of ordnance for the Army. I believe I am familiar with the specifications covering the production of your castings and those covering the assembly of this tank. It is a fact that we require a product that will worthily represent American engineering, skill, and mechanical ability. This fighting tank is a completely integrated, balanced, and wholly, self-contained fighting machine. It is the "Master of the Battlefield."

"Poor castings mean a poor tank, and only one of them might,—like the nail in the shoe of the King's horse,—make (*Please turn to page* 131)



Upper left—Color guard marching with standards of the U. S., the American Legion, and the firm. Center left—Group gathered around mobile broadcasting unit of radio station WIP, Philadelphia. Below—Baseball teams of Cornwall and Lebanon Steel Foundry



Making Nonferrous Test Bars

THERE seems to be some confusion existing relative to specifications in general and those dealing with the castings in the nonferrous metals in particular. Primarily the specifications are intended as a measuring stick by which to judge castings with particular reference to the maintenance of a standard quality and uniformity. However, many engineers seem to assume that specifications for cast metals indicate in the physical properties listed the true characteristics for the average casting of the alloy to which the specification refers.

This obviously is not correct. First, because the physical properties specified are those outside of which castings are to be rejected. In other words, they are minimum or maximum figures as the case may be beyond which rejection occurs and consequently, they do not represent the true figures for the average product of that alloy. Secondly, the physical properties listed refer to those derived from the testing of the test bars which in themselves are more standard than any section of any commercial casting.

As has been mentioned in previous instances some parts of the casting may exhibit physical properties far in excess of those expressed as rejection limits in the specifications, and other parts of the same casting might even be found which were outside the rejection limits and might be cause for rejection were it not for the understanding of this fact when the design was originally laid down. Good engineering practice dictates a definite factor of safety of at least 3 and frequently as high as 5. This means that the designer has planned the casting so that one-third or one-fifth of the physical properties in the rejection limits will still be sufficient to support the stresses set up in the regular use of the castings.

Third, good foundry practice on the part of the foundryman necessarily insures a much better average of physical properties throughout the casting than merely the rejection limits established in standard specifications. Consequently, even though the rejection limits may be assumed by engineers to be those figures outside of which castings must be rejected in order to establish a standard it is not an infrequent experience to find that even when the test bar exhibits figures outside the range established by the rejection limits the castings themselves are entirely satisfactory for service. Under commercial conditions they would give a most satisfactory account of themselves because of the care under which they were manufactured by the foundryman coupled with the sound engineering practiced by the designer who used a safe factor of safety of at least 3 and preferably 5.

In the specifications prepared by the American Society for Testing Materials the details have been worked out (*Please turn to page* 134)

Melting copper-base alloys in open-flame furnaces at the Brooklyn Navy Yard. Photo courtesy OEM

EDUCATIONAL *Training Program* ARRANGED

IN THE spring of 1940 the Hamilton Foundry & Machine Co., Hamilton, O., decided to establish training program for its employes. Various plans were reviewed and after a complete survey of the plant and facilities, John F. Biehl, supervisor of vocational training for the southwestern district of Ohio, set up a 2-year training course, under provisions of existing law.

In 1917 congress enacted the Smith-Hughes law and in 1936 the George Deen law, both of which provide funds for the promotion of vocational education. These laws stipulate the ways and means the federal funds are to be allocated to the various states for the purpose of paying the salaries of teachers, supervisors and directors of agricultural, home-economics, and industrial subjects. The laws further provide that every dollar of federal funds must be matched by a dollar of state or local money or both. Administration of these funds in Ohio is under the jurisdiction of the Department of Education. This department in co-operation with local boards of education has provided eight different vocational training plans, in the field of trade and industrial education.

One of these plans is the part-time, trade extension school. Purpose of this plan is to provide a comprehensive vocational training program of "manipulative processes and related subjects, for the youth of the community who have withdrawn from school to enter gainful occupations." This is the type of program which was instituted at the Hamilton Foundry & Machine Co.

Enrollment in the course is entirely voluntary on the part of the employes. No compensation of any kind is paid for attendance or for work performed. The state Department of Education through the division of the state Board for Vocational Education and the Hamilton City School board, supervise the course and pay the salaries of the instructors. The company provides the facilities of the plant and such material and supplies which may be required, but assumes no further liability.

The course provides for 75 hours of classroom instruction and 75 hours of practical shop work per year. At the completion of the first

1

2

By J. D. JUDGE
Plant Co-ordinator of
Vocational Training
Hamilton Foundry & Machine Co.
Hamilton, O.

year's work, state certificates are awarded and at the end of the second year's work, state diplomas are given. The class room work at Hamilton is handled by two members of the engineering staff. Instruction in shop work is under the supervision of four foremen and assistant foremen. Instructors for classroom and shop courses must obtain state teacher certificates which are issued by the state upon recommendation of the supervisor of vocational training.

Classroom sessions are of 1½-hour duration and are held immediately after the completion of the regular day's work. As originally outlined, shop classes were also to be held immediately after work. However, that plan was abandoned in favor of longer sessions held on Saturday mornings. These sessions originally of 3 hours duration (*Please turn to page* 132)

Fig. 1—Instructor in light molding explaining peening of snap flask mold. Fig. 2—Students placing drag flask on pattern preparatory to making mold. Fig. 3—Coremaking instructor demonstrating the method of rapping a core box. Fig. 4—Students making drag of tight-flask floor job. Fig. 5—Heavy molding instructors explaining operations to State Director of Vocational Training. Fig. 6—Coremaking instructor demonstrating ramming of a core. Fig. 7—Two students making a tight-flask, green-sand, hand-rammed floor job

Silica Flour CONTROLS Molding Sand

By HARRY W. DIETERT,
President
and
GORDON CURTIS,
Test Engineer
Harry W. Dietert Co.
Detroit

IN THE steel foundry considerable use is made of silica flour additions in both core and molding sand. Large percentages of silica flour are added in the case of facing sand and cores for large steel castings. The reason usually given is that silica flour is added to stop metal penetration. This is undoubtedly one very good reason; however, the addition of silica flour exerts other very large changes to the properties of a sand. Such changes in the green, dry, and hot properties of western bentonite bonded sand are well illustrated in the following.

As an example, bond A.F.A. standard silica sand with 4.5 per cent western bentonite and with varying percentages of silica flour, for instance, 0, 5, 10, 15, and 20 per cent. Add sufficient water to temper to best molding conditions and mull for 7 minutes. The total weight of silica sand, bentonite and silica flour is held to a constant value, so that as the silica flour is increased the weight of silica sand is decreased.

The green and dry sand properties of these sand mixtures are tabulated in Table III. A graph of these properties is shown in Fig. 8.

With an increase of silica flour additions, the following values increased: Moisture, green compression, green deformation, toughness, dry compression, and density. Only two properties decreased in value; namely, permeability and flowability.

Increasing silica flour additions from 0 to 10 per cent in the sand caused the moisture, deformation and toughness to substantially double. An increase from 0 to 5 per cent silica flour causes the dry compression to be doubled. This clearly demonstrates the powerful effect of silica flour on the green and dry properties of a western bentonite bonded sand.

When silica flour is added to a western bentonite bonded sand, the green compression increases; in the case of southern bentonite bonded sand, the green compression strength decreases. However, the sand toughness increased for both types of bonds as silica flour was added. Sand toughness, or resilience, is a better index of the workable strength of a sand than green compression singularly.

Determining the properties of the sand at elevated temperatures really exposes the real reason for adding silica flour to a steel sand besides stopping penetration. The high temperature properties of the western bentonite bonded sand are tabulated in Table IV.

The refractoriness of the sand is improved by an addition of silica flour. Using the sintering test as an index, the refractoriness of the sand is increased from 2520 to 2600 degrees Fahr. with 20 per cent addition of silica flour. The contraction of the sand at 2500 degrees Fahr. furnishes another refractoriness index. It shows that the sand without silica flour contracted 0.0125-inch, but only contracted 0.0040-inch when 10 per cent silica flour was added. This increase in refractoriness is helpful where the sand is used for large heavy section steel castings.

The expansion of the sand increases from 0.021 to 0.0255-inch with an increase of 10 per cent silica flour. The expansion value of 0.021-inch is high so that any further increase is a disadvantage. In practice, the high expansion is offset by adding a cereal bond which will increase the void space on the surface of the mold. A graphical illustration of the expansion of the western bentonite bonded sand is shown in Fig. 9.

The hot strength of a sand is of practical value in determining the strength of the sand at the mold face, at that portion of mold just adjacent to the mold face and the mold backing sand. Each of these sections of the mold should possess neither an excess or insufficient amount of hot strength.

This is the concluding article of a series of two articles on silica flour in molding sand. The first appeared in the September issue.

The hot strength of a western bentonite bonded sand may be held to a conservative value for various temperatures by avoiding working the sand with a minimum of moisture. In Table IV it may be noted the hot strength of the sand with 0 per cent silica flour does not exceed 200 pounds. A hot strength of 7 pounds at 2500 degrees Fahr. is a very satisfactory hot strength for both light and medium iron and steel castings. For large steel castings a higher hot strength, in the neighborhood of 10 pounds, is desirable. This may be readily obtained with 1 to 2 per cent silica flour addition. A 10 per cent silica flour addition causes the hot strength at 2500 degrees Fahr. to increase to 40 pounds which will hot crack many steel and iron castings. It is of interest to note that 20 per cent silica flour will raise the hot strength at 2500 degrees Fahr. to 170 pounds, which places the sand in a brick class. Refer to Fig. 10 for a graphical illustration of hot strength.

The hot deformation of western bentonite bonded sand is of conservative value for all temperatures from 500 to 2500 degrees Fahr. The addition of silica flour increases the hot deformation as illustrated in Fig. 11.

Fig. 8 (Top)—Physical properties of Western bentonite bonded sand as affected by silica flour additions. Fig. 9 (Top center)—Expansion is affected by silica flour additions. Fig. 10 (Lower center)—Hot compression strength affected by silica flour. Fig. 11 (Bottom)—Silica flour affects hot deformation

Table III

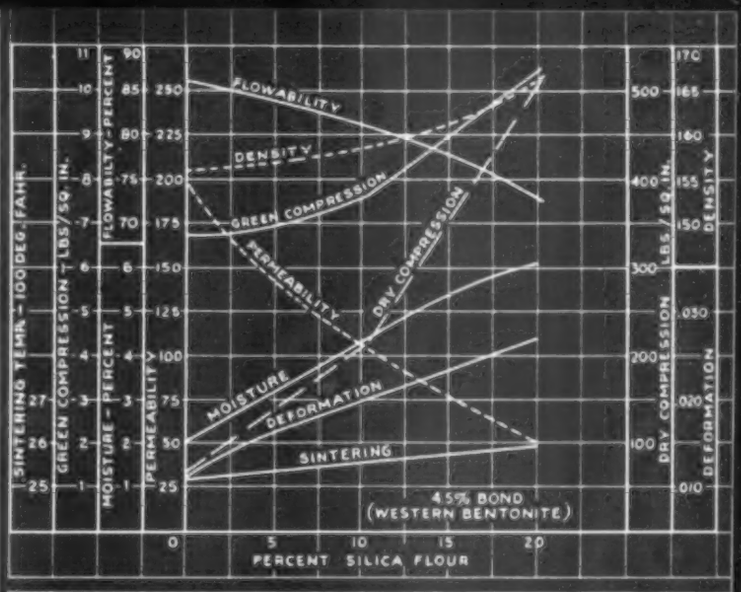
Room Temperature Properties

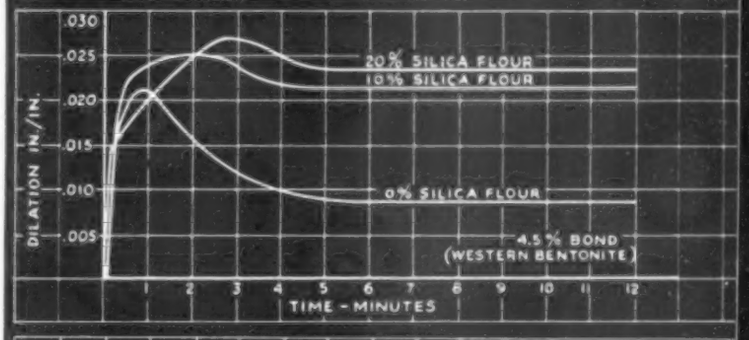
Silica flour, per cent	0	5	10	15	20
Bentonite, per cent	4.5	4.5	4.5	4.5	4.5
Moisture, per cent	2.1	3.2	4.4	5.5	6.1
Permeability	193	146	108	77	50
Green compression, pounds	6.8	6.9	7.5	9.1	10.5
Deformation, inch	0.012	0.016	0.020	0.024	0.027
Toughness	82	110	150	218	284
Dry compression, pounds	69	135	208	355	512
Flowability, per cent	86	84	80	77	73
Density, grams	156	157	160	162	166

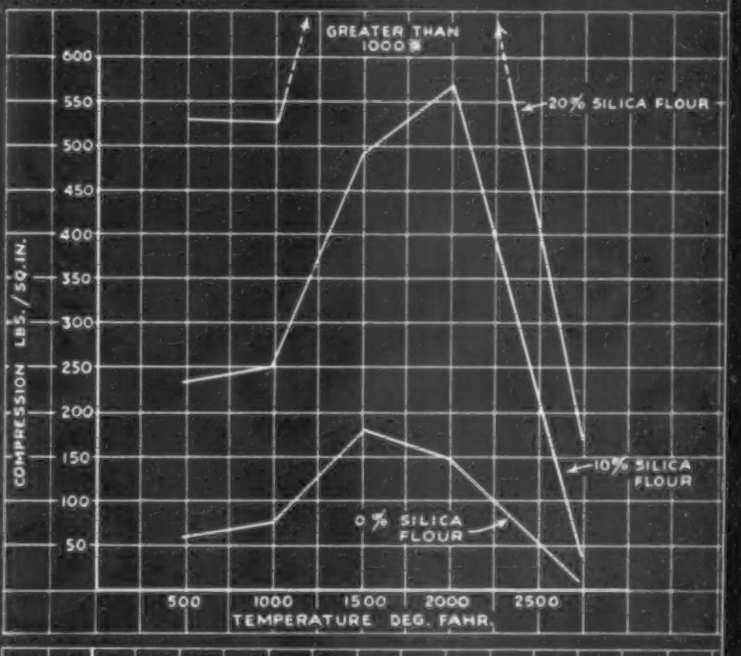
Table IV

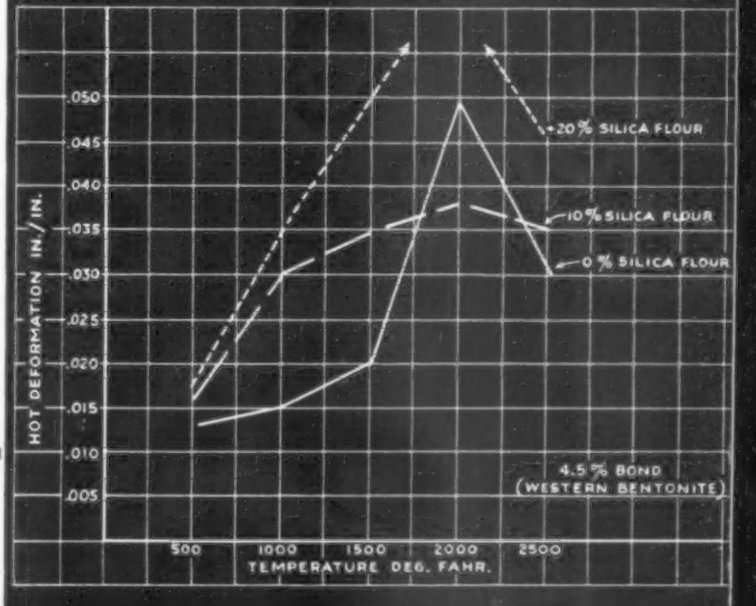
High Temperature Properties

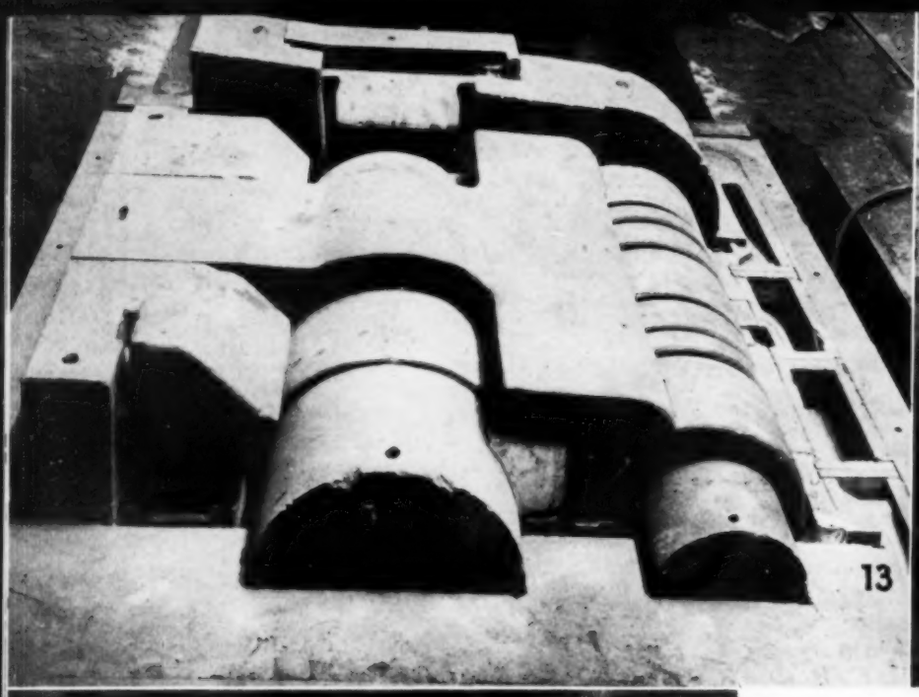
Silica flour, per cent	0	10	20
Bentonite, per cent	4.5	4.5	4.5
Sintering temp. degrees F.	2520	2555	2600
Expansion @ 2500° F., inches	0.021	0.0255	0.027
Contraction @ 2500° F., inches	0.0125	0.0040	0.0035
Hot Strength			
500° F. pounds	60	235	530
1000° F. pounds	75	250	525
1500° F. pounds	180	490	1000
2000° F. pounds	150	570	1000
2500° F. pounds	7	40	170
Hot Deformation			
500° F. inch	0.013	0.016	0.018
1000° F. inch	0.015	0.030	0.035
1500° F. inch	0.020	0.035	0.050
2000° F. inch	0.050	0.038	0.050
2500° F. inch	0.030	0.035	0.045

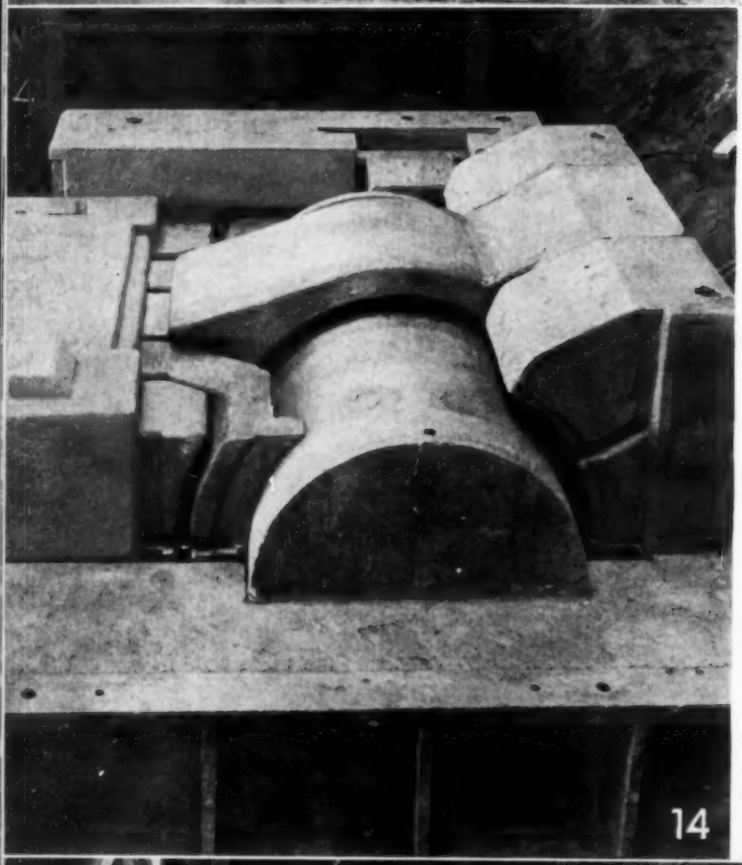










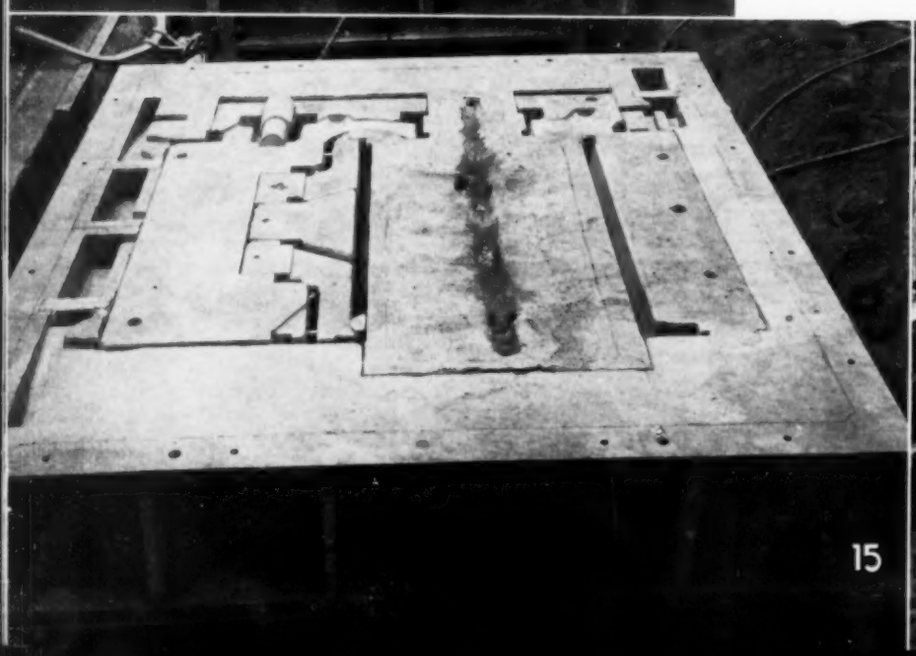


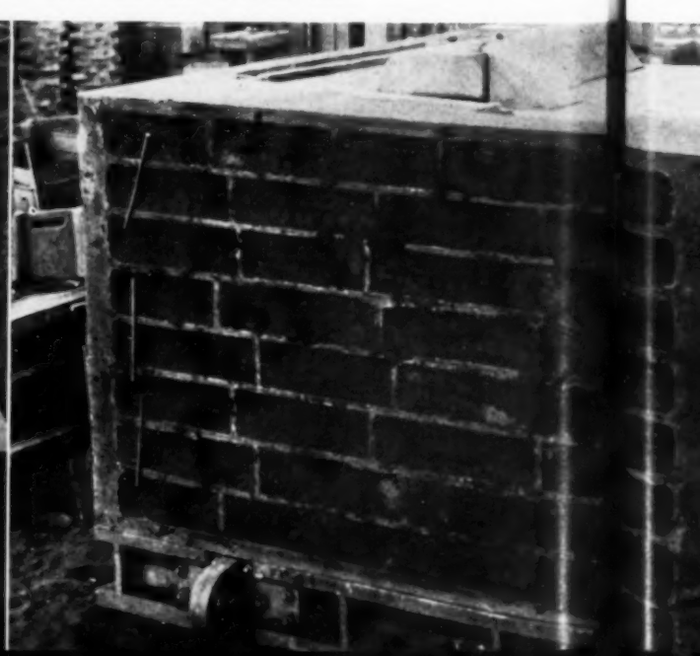
PRODUCING *Marine*

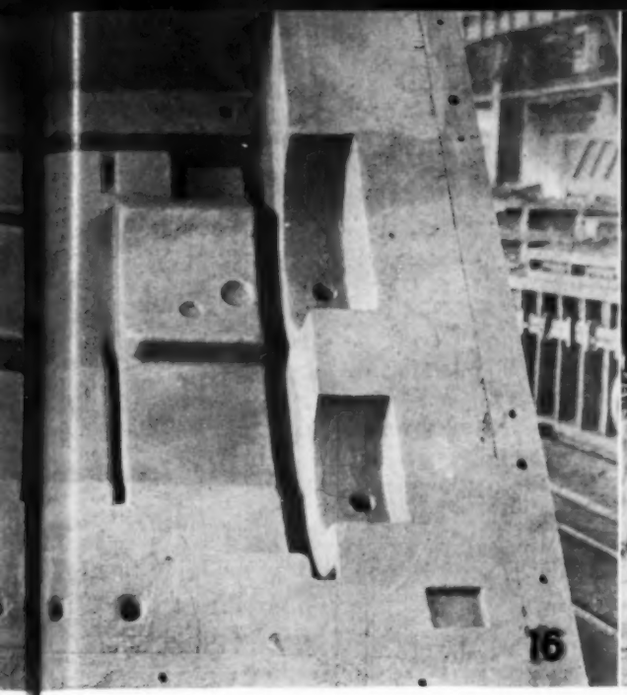
By PAT DWYER

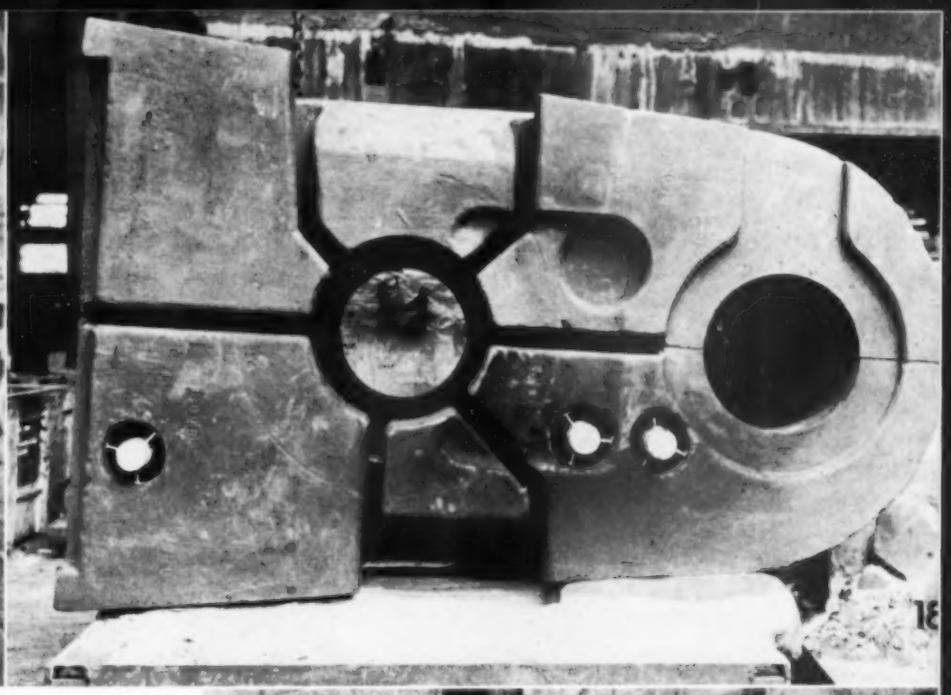
RING patterns for the low, intermediate and high pressure marine engine cylinders were shown in the September issue in Fig. 5 resting against the door openings of a number of corrugated steel structure sheds across a driveway from the Mt. Vernon foundry of the Cooper-Bessemer Corp. This group of

Fig. 13.—High pressure cylinder drag mold with cores completely assembled. Fig. 14—Medium pressure cylinder drag mold showing complete core assembly. Fig. 15—Medium pressure cylinder drag mold with cores set to joint showing metal section. Fig. 16—High pressure steam cylinder cope mold with cores set and tied









Engine CASTINGS

buildings houses thousands of patterns, accumulation of many years of operation, larger ones on the floor and smaller patterns on racks, indexed and numbered through a system of easy identification. Practically all patterns are mounted on strongly built and cleated boards, provided with guide pin holes and in sizes to

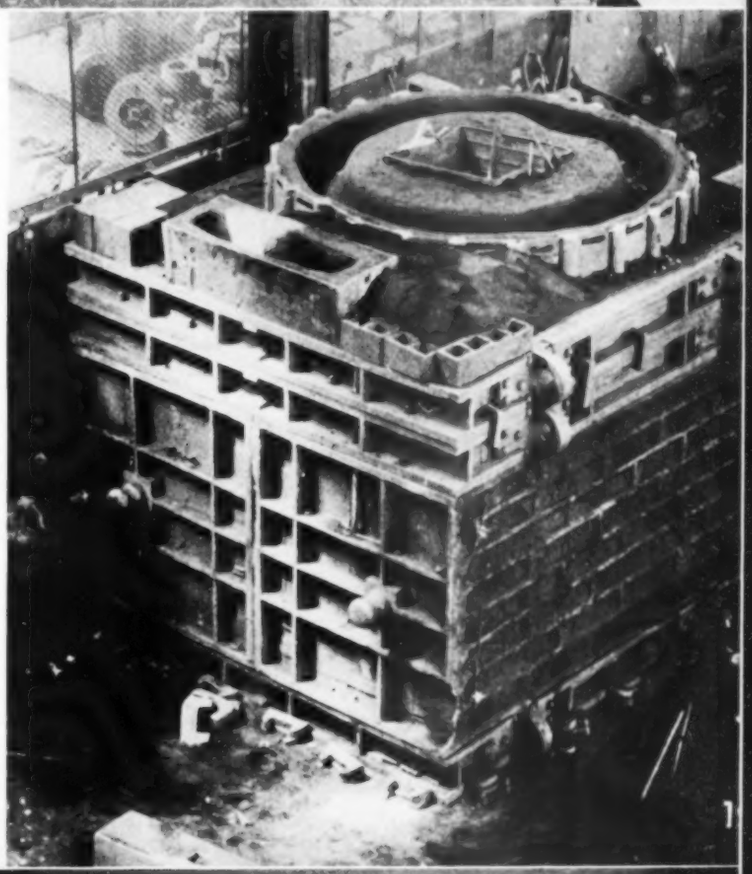
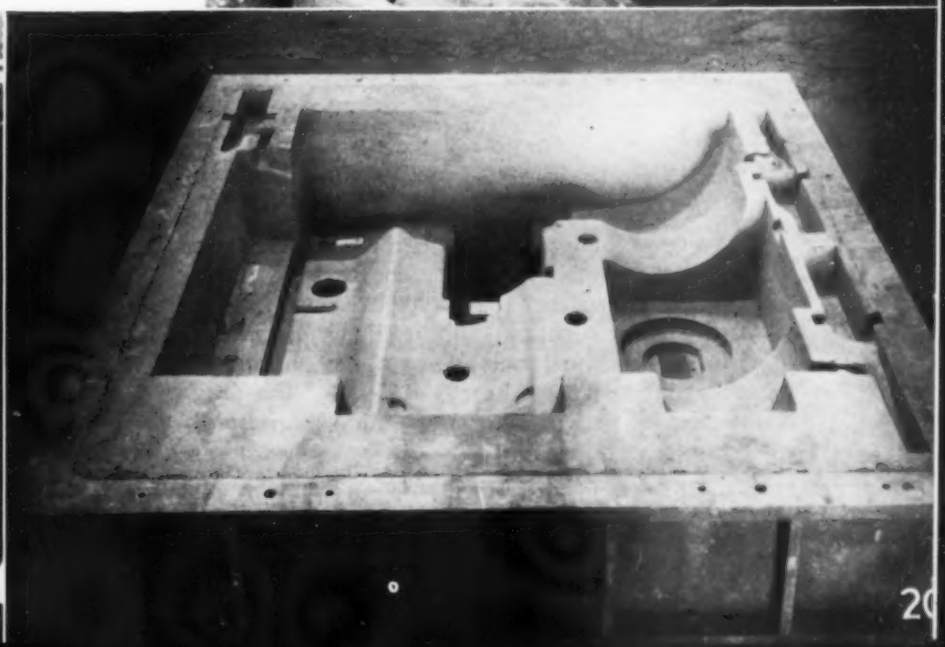
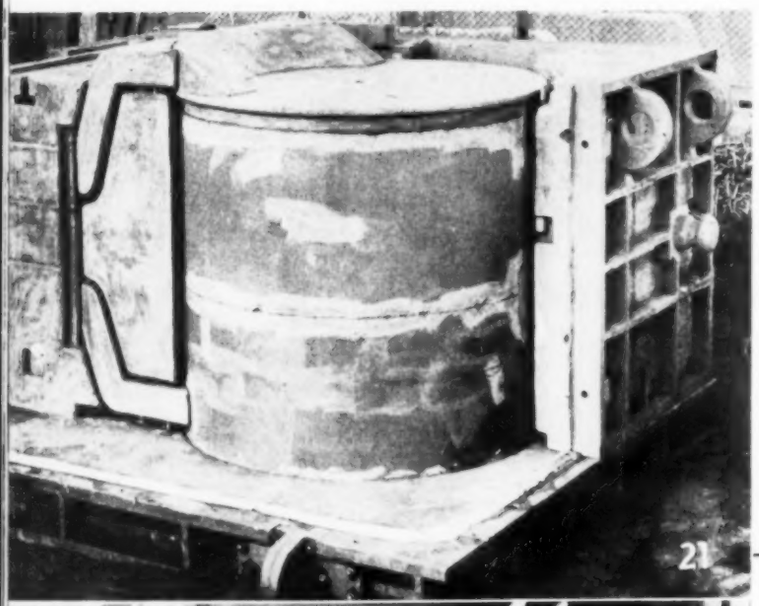


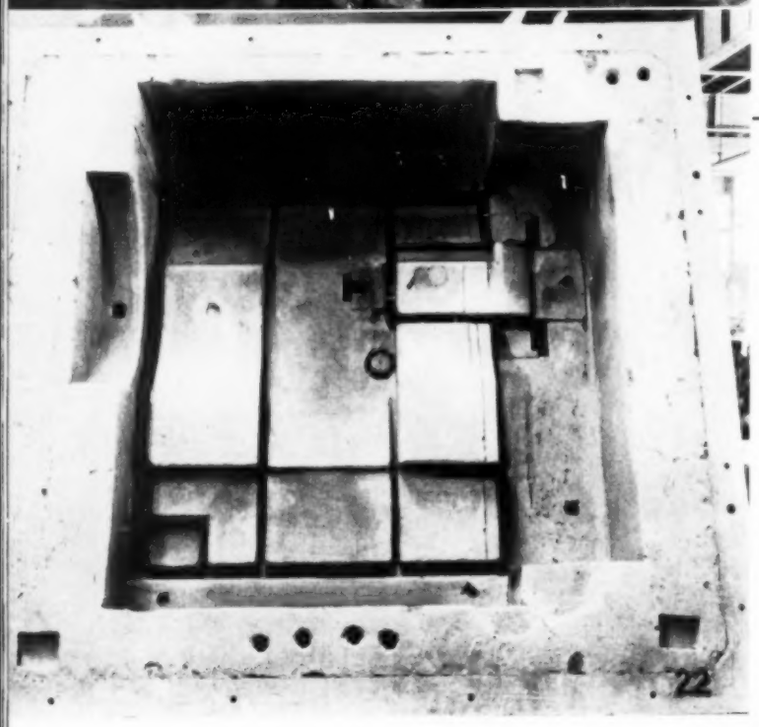
Fig. 17—Low pressure cylinder mold cored up with both cheeks set. Fig. 18—High pressure cylinder end core. Fig. 19—Low pressure cylinder mold closed and ready for pouring. Fig. 20—High pressure cylinder mold ready for cores. Round openings on face are steamers to facilitate drying in oven



correspond to a standardized system of flask sizes.

The patterns are attached to insets which fit in a recess in the main board. Small metal wearing plates inset in the face of the main frame prevent wear from contact with the flange of the flask. With this arrangement one pattern





may be exchanged for another with a minimum amount of time and labor. The arrangement is suitable for either flat or split patterns. In the present instance the entire ring pattern is molded in the drag. The cope may be rammed on a flat board or directly on top of the drag, depending on whether the mold is rammed with pneumatic rammers or jolted on a machine.

Patterns for the low pressure and intermediate rings are mounted on a single board, the smaller inside the larger. Metal is poured through a simple yet highly efficient gate system which produces clean, solid castings without the aid of feeders or risers. A single pouring basin on top of the cope delivers metal to two upright sprues about 6 inches apart. Cast iron plugs are employed to keep the sprue openings closed until the basin is filled with molten iron. Incidentally, this method is practiced on all the larger castings.

Sprue openings on many of smaller molds are protected by pieces of tinned, perforated thin steel plates. The object in each case is to provide a reservoir in which any foreign material will float while the clean iron underneath, enters the sprue. No claim is made that the method is distinctive or original. It is mentioned here merely to indicate the attention to detail which characterizes every item in the long chain of closely synchronized and closely related links involved in the production of perfect castings. Sprue plugs may represent un-

Fig. 21—Low pressure cylinder mold cored up with one cheek set. Fig. 22—Medium pressure cylinder cope mold with cores set and tied. Ready to roll over for closing

necessary precaution in many instances, but they cost practically nothing, involve little or no trouble in preparation or application and constitute a decidedly low form of insurance.

One hundred good castings brings more joy to a foundryman's heart than ninety and nine good castings and even one defective casting where the defective casting may be traced to carelessness or a pinch penny economical program. This seems to be an appropriate place to introduce a famous remark usually attributed to Sir Joshua Reynolds. He probably pinched it. You know what painters are. "Trifles make perfection, and perfection"—here an elegant twirl to the moustache—"perfection is no trifle!" An 8 or 10-ton casting is no trifle either.

Coming back to the illustration it will be noted that the runners and gates form part of the pattern equipment. This assures uniformity of castings and removes one of the variables where the gates are cut by hand. Also passages in the sand formed in this manner are bound to be smoother and cleaner than passages cut more or less at random with a doubled sheet of tin or brass or with one of the hand tools. The runner extends in both directions from the two sprues and in the center be- (*Please turn to page* 127)

Steel Sand Mixtures HAVE CHANGED LITTLE

By HOWARD RAMSEY
Werner G. Smith Co., Division
Archer-Daniels-Midland Co.
Columbus, O.

A GREAT deal has been said and written on steel foundry sands and sand mixes during the past ten years, but when the facts are faced little practical progress seems to have been accomplished. True, there is a little more sand control. Measuring and mixing of sands and binders are watched more closely, but check of present day mixes with those used ten years ago indicates the majority are almost, if not actually the same.

Different Sands Are Used

Even with testing and research work all do not yet agree on the correct sand to use. The author was interested recently in seeing some data accumulated from a questionnaire giving information on green sand facings. Twenty sands were reported and the average fineness varied from 26 to 71.

The grain shape varied from angular to subangular to round. The uniformity of the grain size varied from one extreme to the other. The water content for the green sand facings varied from 2.5 per cent to 4.5 per cent. The permeability varied from 100 to 250. The strength varied from 3.9 to 8.0. There is certainly no consistency in those figures. It was the same ten years ago and ideas seem to be no closer together than at that time.

As far as tests and methods of testing are concerned, results from one shop to another still cannot be compared without running into the danger of error. One reason is that while sand specimens are rammed with three blows of the rammer, all do not have the same foundation under the rammer machine. Some use concrete foundation, some wood and even in some cases, just the dirt floor. A difference in the foundation under the rammer will make a difference in the permeability and strength readings of as much as 30 per cent. Therefore, in comparing results from shop to shop, this foundation matter must be taken into consideration.

Speaking further on this matter of ramming, the author is not so sure that it is correct to set a standard of always using three blows on the sand specimen. It is well known that some facings are easier to ram than others. That being the case, the sand that is easiest to ram always will show a lower permeability because it will pack tighter under three blows of the rammer. In actual shop practice a mold is rammed to a certain hardness regardless of the number of blows required on the jolt machine or by the air rammer—therefore, should not the sand specimens be rammed to a certain hardness no matter how many blows are required for a true comparison of permeability and strength?

Test Conditions Vary Results

Under the system of always using three blows with the rammer a sand with an extra addition of flour or bentonite often can be made to show a higher permeability for the simple fact that the extra addition of these bonds gives a softer and therefore, more open specimen. If the two specimens were of the same hardness the one with more bentonite or flour would have the lower permeability.

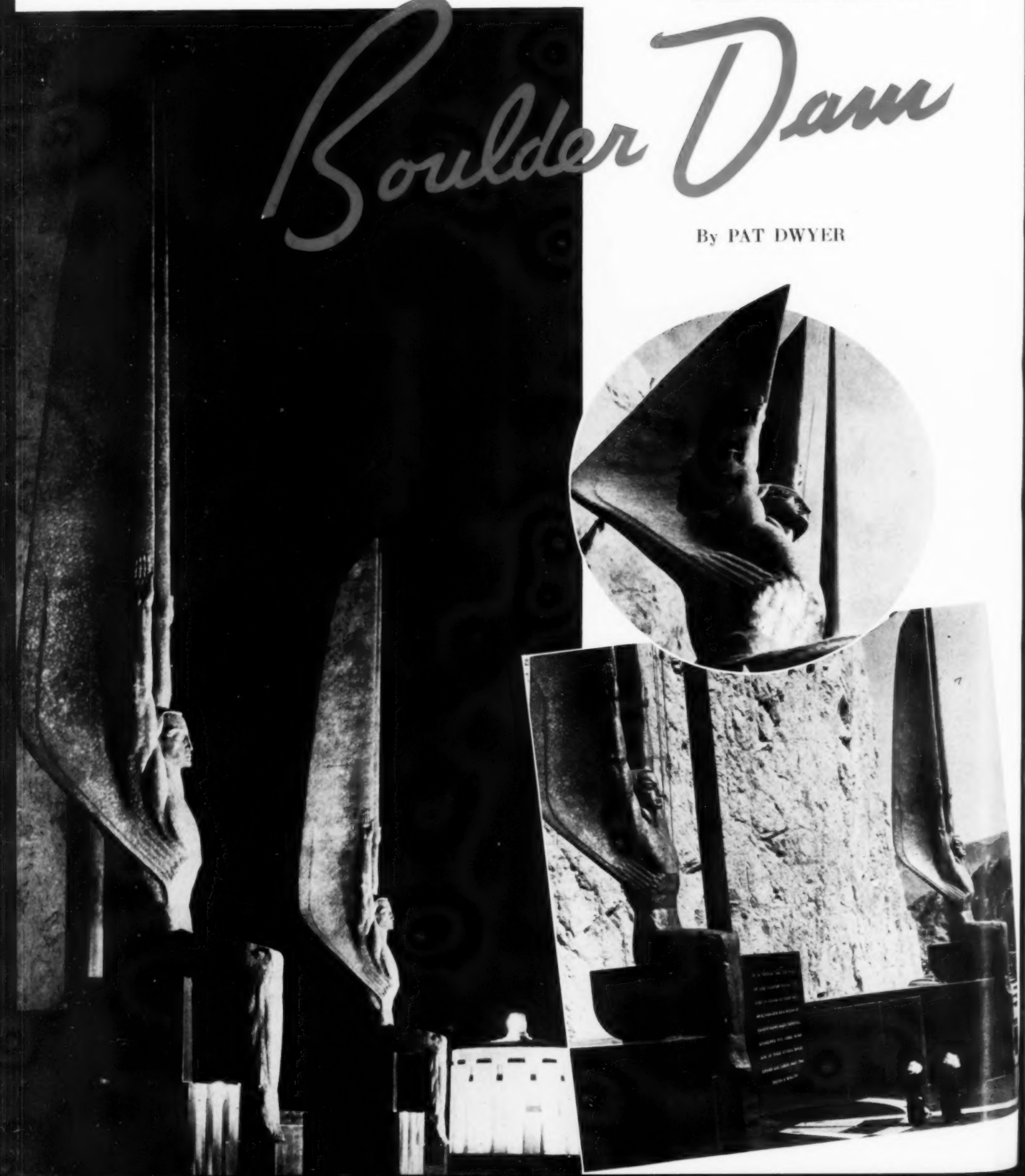
Many foundries pay little attention to the cleanliness of their permeability machines and consequently they become out of order and give false readings. That is a serious matter as certain additions of different sands may be made when not required causing the scrap to go up. To eliminate possibility (*Please turn to page* 137)

HUGE BRONZE FIGURES

ORNAMENT

Boulder Dam

By PAT DWYER



BOULDER dam during the erection period served as a live source for routine news and special articles in newspapers and engineering sections of the technical press, not only in the United States, but in many foreign countries. Since the dam was completed, the great whirling turbines set in motion, and the industrial army with a vast array of mechanical equipment moved north to Bonneville, Grand Coulee and Shasta, the published stories and articles naturally centered around these later developments.

Probably for this reason practically no publicity has been given to the last crowning feature in Boulder dam, the artistic touch which marks the conclusion of any piece of work by a master hand. Two giant bronze figures 30 feet high, 40 feet apart and flanking a flag staff 125 feet high symbolize the height and depth and strength of a Republic conceived in liberty, dedicated to the principle that all men are equal and that nothing is impossible to men with the tools and with the will, the skill, and the ability to use them.

The figures were conceived and executed by Oskar J. W. Hansen, sculptor, Chicago. The bronze castings were molded and cast at the Roman Bronze Works, subsidiary of the General Bronze Corp., Long Island City, N. Y. The following inscription on a bronze plaque at the base of the flag staff requires no elaboration:

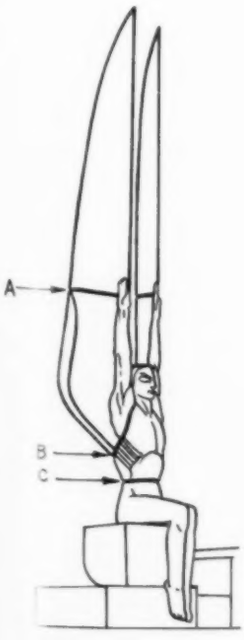
"It is fitting that the flag of our country should fly here in honor of those men who, inspired by a vision of lonely lands made fruitful, conceived this great work, and of those others whose genius and labor made that vision a reality."

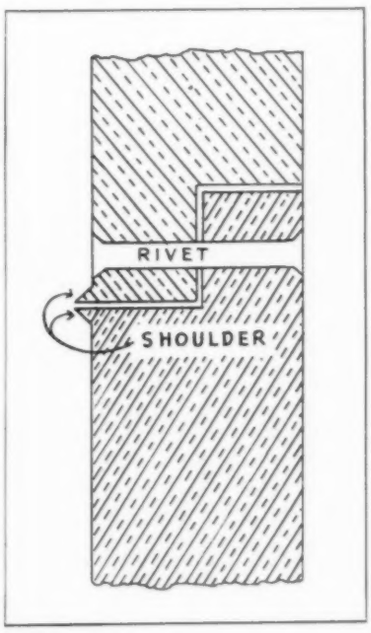
Considering the mass of material published on every phase of the great undertaking, one wonders why two important features were neglected or ignored by the army of writers. One is any reference to Solomon and the other is that no political figure has stepped forward and boldly claimed credit for originating the idea of reclaiming a vast territory of waste land. Strange that no prophet has arisen to claim he foresaw the present need for vastly increased electric power in the unexpected and mushroom growth of the air craft industry in southern California.

Where is this superman who peered into the future and visualized a demand for the total production of this great power station. Who knew 10 years ago before the job was fairly finished, demand would exceed supply. An additional unit rushed to completion in record time is expected to go into action in August.

Approximately 3000 (*Please turn to page* 140)

Fig. 1—Night view of the winged figures with the Nevada intake towers in the background. Fig. 2—One of the two identical figures of the Republic designed by Oskar J. W. Hansen. It is 30 feet high and weighs 4 tons. Fig. 3—Some idea of the height may be gained by comparing the size of the figures with those of the two children. Fig. 4—Sketch showing how the pattern was parted to facilitate molding. Fig. 5—Exaggerated view of a roman joint. Fig. 6—Plaster model or pattern as it appeared in the sculptor's studio





Alloy Additions TO Gray Cast Iron

By G. A. TIMMONS
and
V. A. CROSBY
Climax Molybdenum Co.
Detroit

GENERAL practice used by jobbing foundries producing cupola gray cast iron consists in running the cupola with a more or less standard base iron which satisfies the requirements of the majority of castings. When higher strengths are required in particular castings, certain alloy additions are made to the ladle from which the special parts are cast. There are numerous alloying elements and combinations of elements which may be used as ladle additions, producing satisfactory results.

However, each addition imparts to the iron various characteristics which influence the properties of the iron and its reaction to various treatments. The foundryman must use his discretion in selecting the proper alloy additions for particular jobs and must base his selection upon the cost of the addition and the improvement in properties imparted to his standard, or base, iron by an element or group of elements.

Most cast iron parts are used in the as cast condition but many castings are stress-relieved or annealed before they are machined and put into service. Due to the fact that many gray irons undergo some reduction of hardness and loss of tensile strength when they receive these treatments, it should be to the advantage of the foundrymen to know how the various alloy additions, which he has at his disposal, may influence the resistance of the iron to this hardness *breakdown* so that he can make the most judicious use of the increased cost allotted to him for improvement of his product.

Stress relief is just what the term implies: It is a heat treatment designed to relieve stresses set up in a casting by volume changes taking place during cooling from the casting temperature. Those volume changes result from thermal contraction and from the gamma to alpha transformation which take place as the casting cools to room temperature after solidification has been completed. Stress relieving generally is accomplished by heating the castings to temperatures in the range of 800 to 1000 degrees Fahr., holding about 1 hour for each inch of section, and cooling slowly in the furnace. Some of the alloyed irons

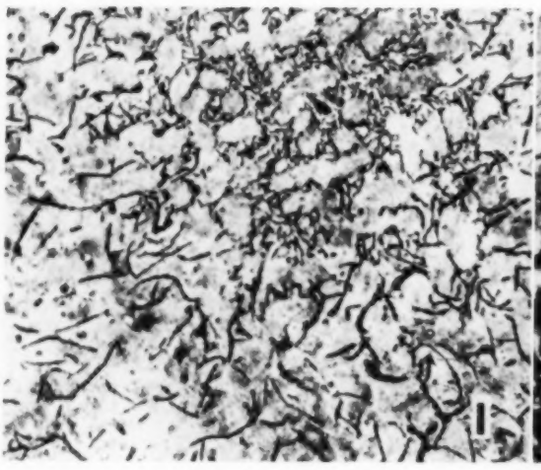


Fig. 1—Graphite distribution characteristic of the 14 irons. 100 diameters, etched in 2 per cent nital. Fig. 2—Matrix structure No. 7 iron as cast. 1000 diameters, etched in 2 per cent nital, BHN 269, tensile strength 50,000 pounds per square inch

are heated to temperatures approaching 1200 degrees Fahr. to accomplish the same purpose.

Annealing of ferrous alloys, theoretically speaking, involves the heating of the part to temperatures above the upper critical temperature and furnace cooling. The term applied to gray cast iron, however, may have three interpretations: a) heating to temperatures of about 1750 to 1800 degrees Fahr. to soften castings containing primary cementite to induce graphitization of the carbide phase and thereby improve machinability of the casting; b) heating a gray iron casting to 1500 to 1600 degrees Fahr., just above the upper critical temperature, and slowly cooling it to soften the iron for rapid machining; c) heating the iron to just below the lower critical temperature, 1250 to 1400 degrees Fahr., to graphitize a portion of the combined carbon to soften the iron for machining purposes.

The foundryman seldom has the opportunity to evaluate the various commercial alloy additions to gray iron by a direct comparison of these additions alone, all other factors being controlled or held constant. Usually, there are sufficient variations in such factors as base composition, superheating temperature, additions of inoculants, types of molds, cooling rates, etc., to make a direct comparison impossible. In the present investigation the authors attempted to hold constant as many of these factors as possible, to determine the efficacy of the more or less common alloy additions to gray iron with respect to the mechanical properties produced in the as cast condition and after subjecting the castings to various annealing treatments.

Considering the commercial aspects of the problem, such as the range of strengths generally required, the cost of the alloy additions and the mechanical properties and sensitivity to hardness breakdown during high temperature stress relieving or annealing, a base iron of approximately 3.25 per cent carbon, 2.00 per cent silicon, and thirteen alloyed irons, produced by making ladle additions to this same base iron,

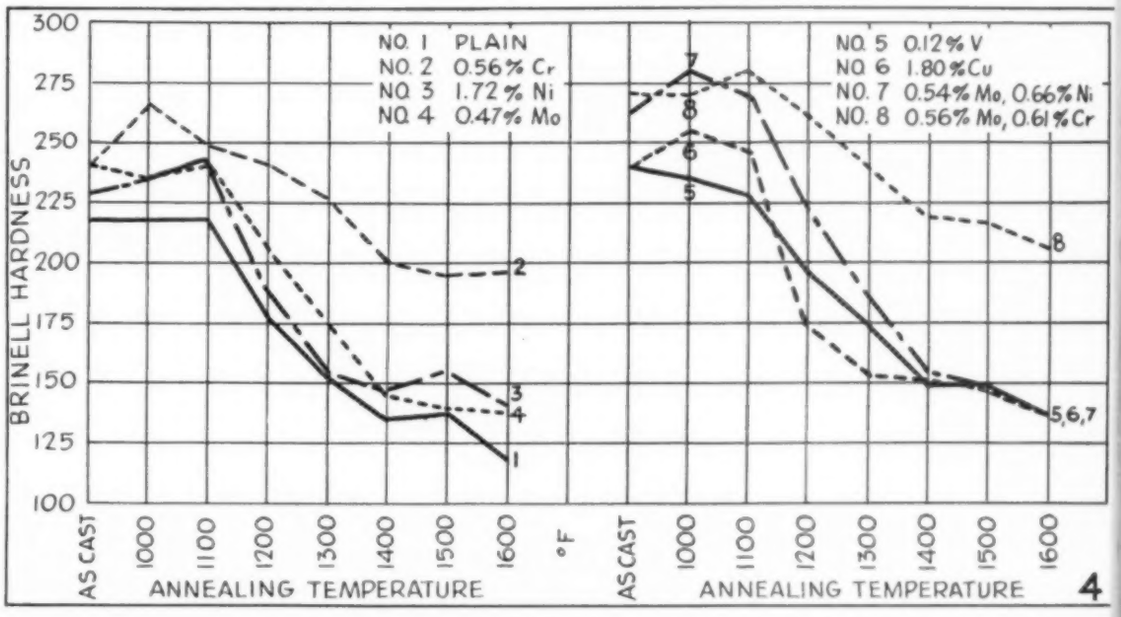
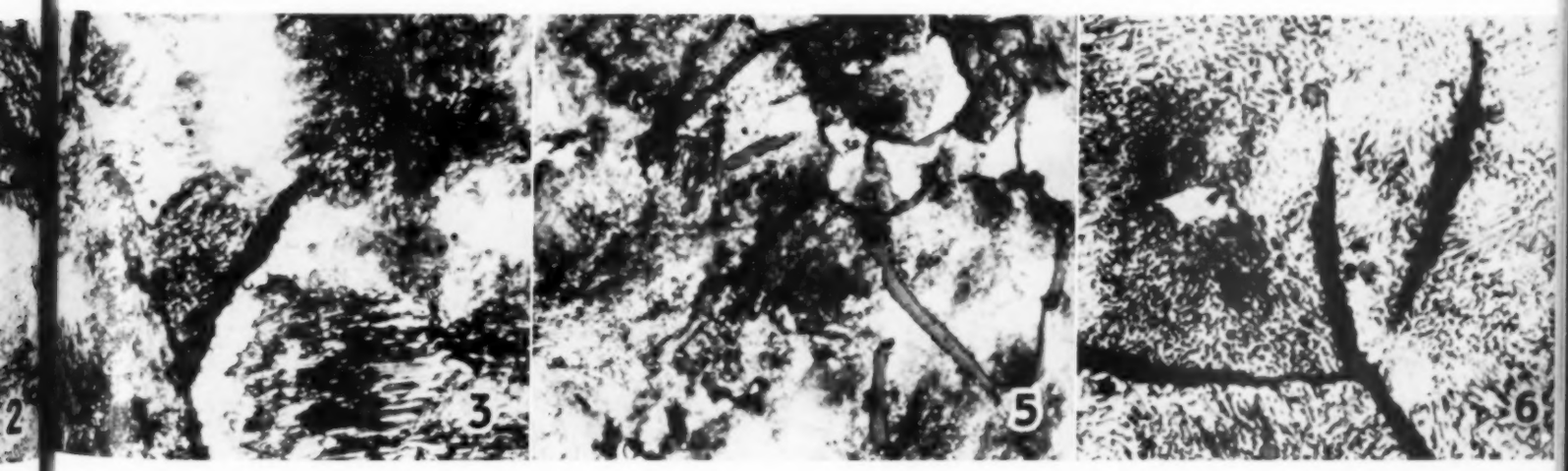


Fig. 3—Matrix structure No. 9 iron as cast, 1000 diameters, etched in 2 per cent nital, BHN 269, tensile strength 52,400 pounds per square inch. Fig. 4—Chart showing curves of annealed irons. Fig. 5—Matrix structure No. 12 iron as cast, etched in 2 per cent nital, BHN 285, tensile strength 55,500 pounds per square inch. Fig. 6—Matrix structure No. 14 iron after annealing at 1400 degrees Fahr., BHN 207, tensile strength 43,100 pounds per square inch



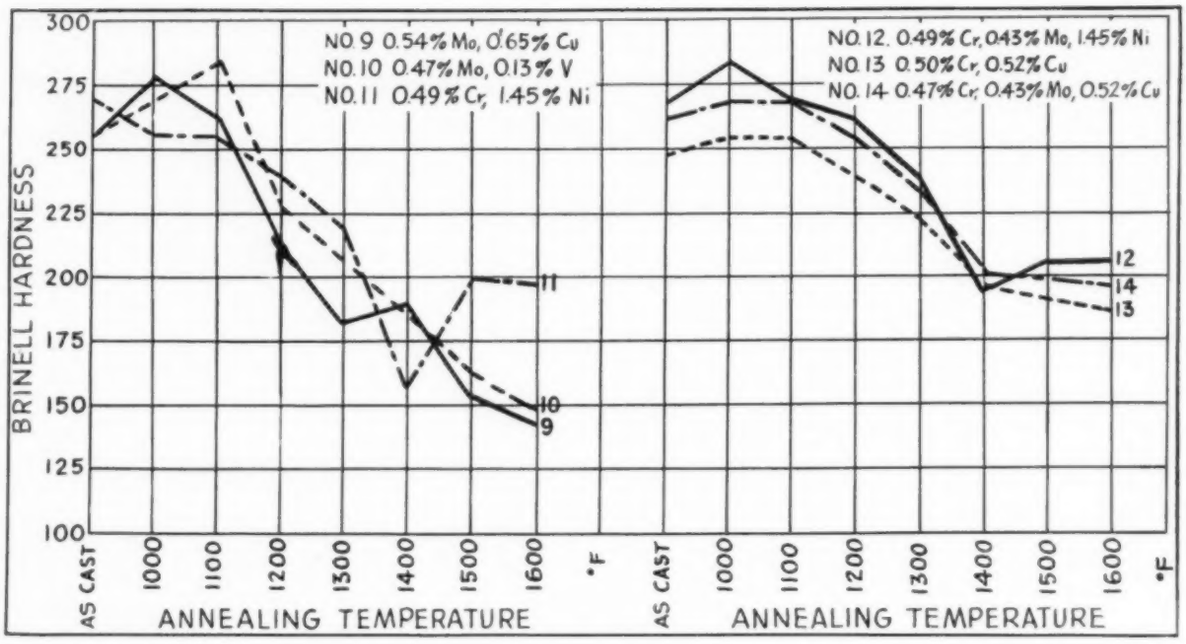


Fig. 7—Chart showing curves of irons Nos. 9 to 14 annealed at various temperatures

have been made and compared in an endeavor to furnish a basis for recommendations and specifications.

One 500-pound heat of cast iron was melted down in a 1000-pound Detroit rocking furnace, charging pig iron and steel scrap as generally used in a production foundry. The melt was superheated to 2750 to 2800 degrees Fahr. and poured into 30-pound hand ladles from which test bars were cast. A late addition of 0.25 per cent silicon was made to each ladle in the form of pulverized 75 to 80 per cent grade ferrosilicon. For the plain iron test bars, the late addition of silicon constituted the only ladle addition. All alloy additions were made in the 30-pound hand ladle, the molten base iron being poured onto the additions in the ladle. These additions in every case included the late silicon addition. Complete solution of the alloying elements was effected by stirring.

Two A.S.T.M. B-test bars (A48-36) were produced from each ladle of iron. These were cast in baked sand-pipe molds with their axes in a vertical direction. All bars were cast when the molten iron had attained the temperature of 2600 degrees Fahr. This pouring temperature was carefully maintained, each ladle of iron being observed with a Leeds & Northrup optical pyrometer, and the metal was held in the ladle until it had reached this temperature. All bars were cooled to room temperature in the molds.

A transverse test was run on one bar of each composition. These (*Please turn to page* 145)

Table I

Compositions and Physical Properties of the Irons

Bar No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chemical Analyses:														
T.C. %	3.28													3.23
Si %	1.93													1.92
Mn %	0.96					Same Base Iron Used Throughout								0.93
S %	0.030													0.032
P %	0.110													0.114
Cr %	....	0.56	....	....	0.05	....	....	0.61	....	0.05	0.49	0.49	0.50	0.47
Mo %	....	....	....	0.47	....	....	0.54	0.56	0.54	0.47	....	0.43	....	0.43
Cu %	....	....	....	....	....	1.80	....	....	0.65	....	....	....	0.52	0.52
Ni %	....	....	1.72	....	....	....	0.66	....	....	....	1.45	1.45	....	....
V %	....	....	....	....	0.12	....	....	....	....	0.13	....	....	....	....
BHN as cast 1.2" diameter section	217	241	235	241	229	235	269	262	269	269	255	285	241	248
Transverse Test														
Max. load, lbs.	2330	2640	2460	2640	2580	2600	3170	3170	3210	3040	2730	2990	2420	3170
Deflection at max. load, in.	0.235	0.227	0.235	0.255	0.234	0.247	0.293	0.264	0.301	0.255	0.235	0.236	0.204	0.255
Tensile Strength, p.s.i.	37,400	41,700	41,700	44,000	41,000	43,500	50,000	46,200	52,400	48,400	45,400	55,500	43,000	50,600
Tensile Strength after annealing at 1400° F.	27,700	40,000	29,900	31,600	31,200	29,900	33,000	44,500	37,400	40,000	34,800	42,600	38,200	43,100
BHN	143	207	149	146	156	143	156	217	187	179	156	197	201	207
Tensile Strength at BHN 207-217	37,800	41,300	38,200	43,000	41,000	41,800	42,600	46,200	44,000	47,000	43,500	45,400	41,800	43,600
BHN	217	212	212	217	217	217	212	217	217	217	207	212	217	217

QUESTIONS and ANSWERS

Use Core in Place of Loose Piece Without any Taper

Patterns from outside sources sometimes have loose ribs or other parts attached to the sides and designed to be drawn into the mold cavity after the main pattern has been drawn out of the sand. The loose pieces have no taper. They are in position where they cannot be rapped. The sand edge is broken in removing them. We shall appreciate advice on how to handle this problem.

Three alternative methods are submitted for your consideration. Adoption of any one depends to a great extent on local conditions; attitude of customer; size, shape and position of loose piece; and relative cost. On the first item, a possibility exists that upon proper presentation, the customer might agree to taper the pieces so that they might be extracted easily. In the second alternative method the strip or loose piece is molded in a small dry sand core. This core is rammed up with the pattern in the mold. In some instances a regular corebox is necessary, while in other instances, usually of an emergency character, the piece is attached to the pattern and surrounded by a small wood frame which serves as a corebox. The third alternative method is to use a tin form. The form is laid up against the pattern and rammed in place.

Metal Kicks From the Steel Rods Used as Inserts in Casting

Metal kicks to a certain extent from ¾-inch diameter steel rods used as inserts in some of our iron castings. We shall appreciate information on the proper method of treating these rods.

Metal inserts must be perfectly clean and dry to prevent the molten iron from kicking. The kicking or boiling action is caused either by steam or gas, or possibly from both. The steam comes from dampness and the gas comes from rust, another name for iron oxide. Where the gate can be arranged to keep a stream of iron flowing past the insert, the steam or gas is carried away. This method should be adopted wherever practicable. In addition to preventing the formation of steam or gas holes, the action of the flowing stream partly or wholly fuses the skin of the insert and anchors the insert solidly in the casting. Where the insert is used merely as an internal chill, this feature is of no special importance.

In some instances it is necessary to clean the inserts and then coat them with tin, copper or nickel. This coating promotes close union of the insert with the surrounding metal and does not create steam or gas. In the majority of instances this extra precaution is not necessary. The inserts are cleaned either in an acid bath or in any convenient form of pressure blast device. They are sprayed with or dipped in kerosine, gasoline or any thin oil and placed immediately in the mold. The oil protects the surface from the oxygen in the air and the consequent formation of a thin film of iron oxide, usually invisible to the naked eye. Obviously, the molds containing metal inserts should be filled with metal as soon as possible. The insert has a tendency to condense moisture on the surface. The tendency is accentuated where the sand is warm and the insert is cold.

Oil Fired Cupola Has Not Proved A Successful Melting Unit

In a paper in a recent issue of THE FOUNDRY under the title "Marks Progress in Melting Gray Iron," reference is made to the use of oil as a melting medium. We melt iron in a cupola with coke at $23 per ton. We shall appreciate further detail, style of furnace, burner, volume of oil and air and any other pertinent features.

We are indebted to D. J. Reese, International Nickel Co. Inc., author of the paper you mention, for the following reply to your inquiry: A German cupola development of 1930 or a year or two earlier was the Marx oil fired cupola. The Ford Motor Co., installed one of these cupolas about 5 years ago. The original form has been modified greatly so that the design now is approximately a combination air furnace and cupola and the heating medium has been changed to pulverized coal. Gray iron can be melted in an oil fired rotary furnace, but the capital investment in this type of furnace is considerable. Amount of oil per ton of iron melted will depend on the time the furnace is in use daily.

A 1-ton capacity furnace, used 4 or 5 times a day, would consume between 50 and 60 gallons of oil per

ton of iron melted at a temperature of 2800 degrees Fahr. About 800 cubic feet of air per minute would be required. This is a batch type furnace with heats every 2 hours. Even though coke costs $23 per ton, the cupola is the most economical furnace. If you do not specify a sized coke, you may be getting a coke too large. A good size is 1/12 the diameter of the cupola, for example 3-inch coke for a 36-inch cupola. If the weights of coke and iron charges are not in proper relationship to the cupola diameter, you will not get maximum results from the fuel. Many cupola men do not weigh coke. They might experience a surprise and a key to some of their troubles if they actually weighed the coke instead of measuring it with a fork or scoop.

White Spots Occur On Brass Casting

We operate a small brass foundry and will appreciate any information that you might give us in connection with an unaccountable bit of trouble we are experiencing every day. Our castings while sound and machining satisfactorily nevertheless have a bad appearance on the cope side, a white film usually covering the castings which have this flurried surface. We use a good grade of composition but lacking a pyrometer we judge the molten metal by the manner with which it adheres to an iron rod which we immerse in the crucible. We have given thought and time to experimenting with gating, risers, etc., but with no apparent success. It might be wise to mention that a casting typical of our work are the boat struts and shoes weighing from 15 to 50 pounds.

Judging from the type of casting that you are making we assume that you are using yellow brass or at least a grade of brass that is relatively high in zinc. Having no definite information on this we only are offering an explanation of your difficulty based on the assumption that it is a composition in which zinc in considerable quantities is present. The white spots on yellow brass are known as zinc spots or zinc oxide marks.

Those are caused by the vaporization of the zinc which is oxidized to form zinc oxide. That material adheres to the cold surface of the mold and when the mold fills is transferred to the casting. There is one other source of such trouble that may have some bearing on your problem, particularly if you are using red brass instead of yellow brass and you are adding some gates, risers and sprues of scrap that has been contaminated by the presence of some of the modern silicon bronzes or that has had additions of aluminum.

Silicon in the red brass will make a white mark on the cope side of the casting if it is present in any considerable quantity. All the specifications of the American Society for Testing Materials on high grade red brass demand that the silicon content should be below 0.25 per cent, and it is better to follow this rule where at all possible. It is not an uncommon experience to have scrap contaminated by the presence of silicon now that silicon bronze is becoming so much used as a substitute for the copper-tin bronzes, tin now being strategic metal and therefore must be conserved in the interest of national defense.

The only cure for zinc spots is to pour the casting so strongly that the molds fill rapidly and if the size and number of gates will not enable you to pour sufficiently rapidly to avoid these spots the number of gates should be increased and size of sprues arranged so as to accommodate the strong pouring required to prevent the difficulty. The cure of course for silicon discolorations is to avoid the contamination of your composition with silicon or silicon compounds.

Piston Rings Show Many Gas Holes

We melt iron for piston rings in a small home made cupola 19 inches inside diameter. We melt from 1000 to 1200 pounds per heat without any trouble except some gumming up of the slag at the end of the heat. Some of the castings when machined show little round gas holes or blow holes under the skin. We put about 1 pound nickel shot in the stream flowing into a 100-pound ladle. What is the best way to soften iron? Which is preferable, to add ferro silicon to the cupola charge, or add it in the ladle. What is the best flux to use in small cupola?

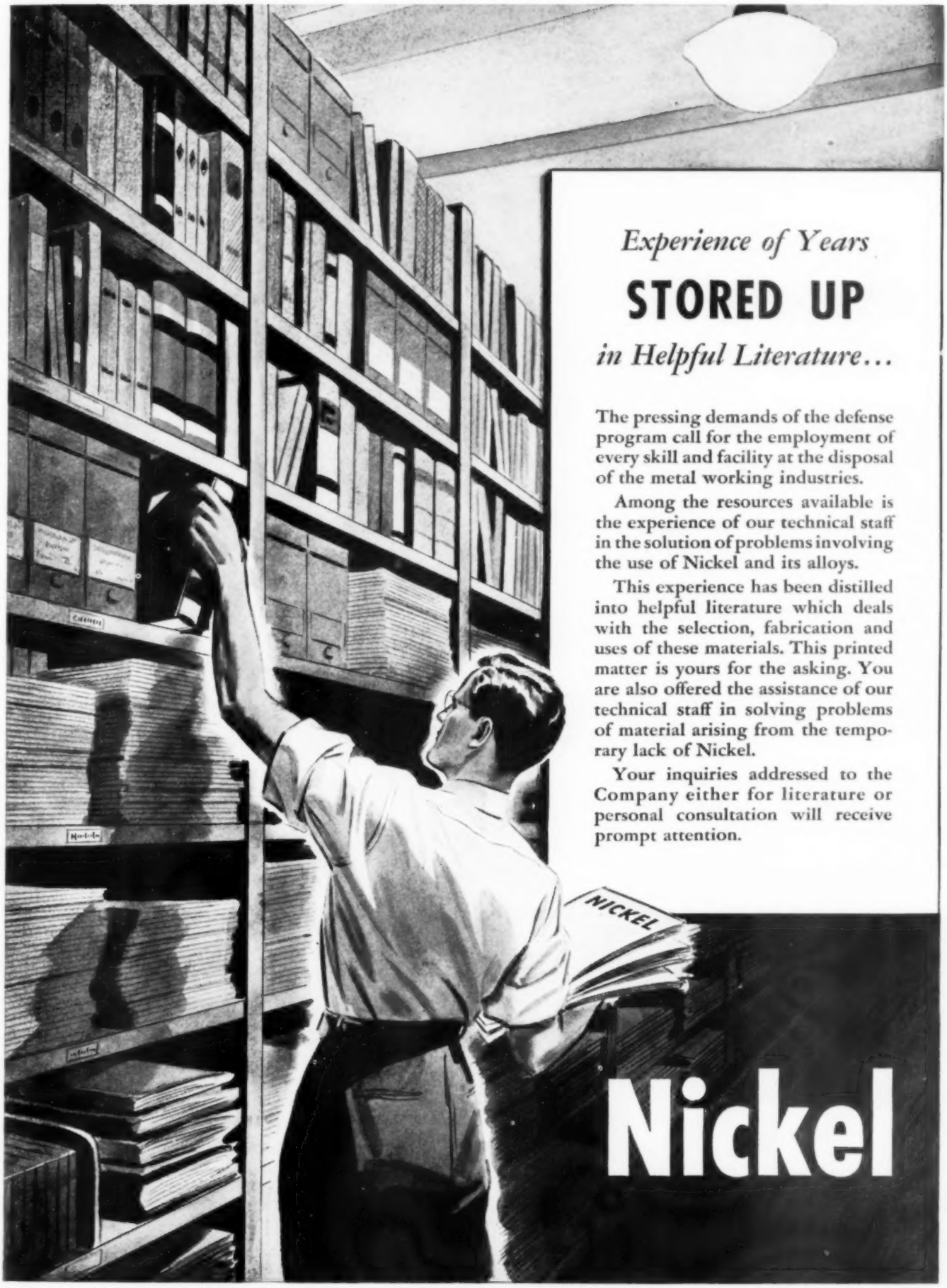
Blow holes or gas holes in a casting may be traced either to melting or molding practice and to both in some instances. Basing an opinion mainly on your statement that the holes are small and round we should place the blame on the melting practice. Where the bed is low in the cupola and the blast is strong, the metal becomes more or less oxidized. Another possible source of steam or gas inclusion is a damp ladle. As a first step in your investigation we suggest increasing the height of the bed coke and reducing the volume and pressure of the blast. You do not state how the blast is supplied, or how it enters the cupola, that is the size and number of tuyeres.

For a small cupola probably the best arrangement is a Y extension to the main blast pipe terminating in two tuyeres on opposite sides of the cupola. These tuyeres may be from 2 to 3 inches diameter through the shell and then gradually expanded to a rectangular shape 2 x 8 inches at the face of the lining. The expanded opening in the tuyeres allows the air to expand and enter the cupola in sufficient volume, but at reduced pressure. The cupola has a theoretical melting capacity of approximately 1 ton per hour and requires about 500 cubic feet of air per minute. Six or eight pounds of limestone on every charge will liquify the slag. Tap it through a slag hole at the back either continuously or each time before the iron is tapped to secure a clean drop and a clean lining.

Gas Holes Due to Several Causes

Recently we made some changes in our cupola and now we find gas holes in the castings. Do you think there is a connection between the recent changes and the gas pockets. What causes are responsible for the gas pockets?

Several causes are responsible for gas holes in castings. These causes may lie in the melting or molding process. Since the defects (presumably) appeared after the changes were made in the cupola, it is reasonable to assume that in this instance the cupola is to blame. You do not state the character of the changes, therefore we only can guess at a solution of your problem. For example, if you have raised the tuyeres without a corresponding raise in the coke bed, the move is equivalent to a lowering of the coke bed under formerly satisfactory conditions. If you have increased the volume or intensity of the blast, without a coresponding increase in the volume of coke consumed in a given period, some of the oxygen becomes united with the molten iron and is trapped to form the gas holes. Where the bed is the correct height at the beginning of the heat, an insufficient amount of coke between the metal charges gradually will reduce the height of the bed and the result will be the same. Without a knowledge of all the factors, weights and measurements it is impossible to suggest a definite formula for the size of the charges of coke and iron, or the volume and pressure of the blast in this particular instance. One or two revisions will enable you to adopt the proper procedure to obtain satisfactory results.



Experience of Years

STORED UP

in Helpful Literature...

The pressing demands of the defense program call for the employment of every skill and facility at the disposal of the metal working industries.

Among the resources available is the experience of our technical staff in the solution of problems involving the use of Nickel and its alloys.

This experience has been distilled into helpful literature which deals with the selection, fabrication and uses of these materials. This printed matter is yours for the asking. You are also offered the assistance of our technical staff in solving problems of material arising from the temporary lack of Nickel.

Your inquiries addressed to the Company either for literature or personal consultation will receive prompt attention.

Nickel

THE INTERNATIONAL NICKEL COMPANY, INC. **67 WALL STREET NEW YORK, N. Y.**

All Pattern Metals Will Shrink

We would appreciate having some information on the composition of a pattern metal which is non-shrinking.

Since all metals and alloys shrink or decrease in volume to some degree, there actually is no non-shrinking metal. However, there are some which shrink so little that it will meet requirements in pattern work of the usual dimensions. One contains 88.9 per cent tin and 11.1 per cent antimony which has a low melting point, and cleans up easily. Unfortunately its high tin content makes it quite expensive, and in this time of tin shortage for defense work, it will be necessary to go to some other material. An aluminum alloy while it is not non-shrinking, will serve if the proper allowances and precautions relative to shrink are provided. However, at present unless the pattern is for direct or indirect defense work aluminum is not available. Hence, for non-defense work you will have to employ wood, iron, brass, pattern compositions, etc.

Chill Determined By Composition

We are manufacturing gray iron castings 14 x 21 inches 1⅛ inches thick. The cupola charge contains 55 per cent high-carbon steel scrap and 45 per cent No. 1 cast iron scrap. The surface on one side of the casting is chilled from the point of the casting approximately 12 inches and the full width. The castings are left in the molds for 1½ hours before they are shaken out. We are wondering if that has an annealing rather than a chilling effect. The chill is 1½ inches thick. We also shall appreciate any available information on the subject of chilling the tread on car wheels.

Chilling a casting is the ordinary foundry term for the more scientific term of holding a greater amount of the carbon in the combined form than usual. In the molten condition all the carbon is in this form. Thickness of the casting, thickness of the chill, composition of the iron, pouring temperature, singly or in combination, determine what proportion of the carbon remains in combined form, and what proportion takes the form of free or graphitic form. Where iron is cooled rapidly, for example in contact with a chill, the carbon remains in the combined form and the metal is white in fracture and exceedingly hard.

From the wording of your inquiry as to whether holding the casting in the mold has an annealing or chilling effect, we assume that the castings are not chilled to the anticipated depth. The subject of chilled castings is so involved and based upon so many variables, that a general dissertation on the subject could not be covered in any presentation less than full book length. However, in the present instance it may be sufficient for your purpose to state that the depth of chill is not affected by the time the casting remains in the mold.

Your trouble is caused by the use of a chill that is too light to extract the heat rapidly enough from the casting and thus hold the carbon in the combined form. On a casting 1⅛ inches thick, a chill should be at least 2½ inches thick to be properly effective. On the subject of car wheels, one of the most highly specialized branches of the foundry industry, your inquiry takes in too much territory. Many interesting features in the operation of a prominent car wheel plant were presented in the Aug., Sept., and Oct., 1940 issues of THE FOUNDRY.

Iron Casting Leaks Under Pressure

We are forwarding for your inspection a small gray iron casting, about 3 inches diameter, 4 inches in length, open at the hexagonal end and closed at the other end and with a lug or bracket on each half. The pattern is split in the center and molded with one bracket in the cope and one in the drag. Four patterns are mounted on a plate and the mold is made in a snap flask with a gate entering each casting at the side of the core at the open end. One core serves for two castings. Castings in the group shown by the sample leak at junction of lug with body.

Composition of the metal is not a factor in producing porosity in the areas where the cope lug joins the body. Presumably a central sprue feeds metal to the four castings in a mold. The sprue, the gates, the high lugs create more than a normal amount of steam. Vent from the four cores presumably escapes through two small channels scratched in the joint of the mold on opposite sides. The mold is reinforced with a jacket or band and the cope is held down with a flat weight. Excess steam and gas causes the metal to flutter slightly and to form the porous areas. The pocket on the side of the core may be a slightly contributory factor. The remedy is to provide larger channels for the escape of the core gas and to vent with a wire around the lug in the cope. The flat weight on the cope is not suitable for this job. Provision should be made on the bottom of the mold for the escape of gas and steam. That is accomplished easily by use of a perforated bottom board, and unless the gases and steam can escape without difficulty blows and agitation are bound to occur.

Lining Burns Away In the Cupola

We operate a 27-inch inside diameter cupola with a coke bed 40 inches high, first charge of iron 800 pounds, succeeding charges 50 pounds coke and 400 pounds iron. Coke analysis shows carbon 87.78 per cent, ash 6.76 per cent, volatile 4.14 per cent. Wind pressure is 6½ to 7 ounces. We use nettle brick for lining the cupola at the melting zone, but they only last about 2 heats.

Your statement that you are using *nettle* brick for lining the melting zone apparently is a slip of the pen and really should be *metal*. However, metal bricks are used only in the space extending a few feet below the charging door. Their function is to resist abrasion of the lining during the charging operation and while the accumulated material is descending. Certainly one would not expect them to stand up in the intense heat of the melting zone where they would melt as readily as the iron charges passing through this zone.

The practice of placing a double charge of iron on the bed was favored by some foundrymen for a considerable period in the belief that a charge of coke was saved thereby. Under the supervision of a skilled melter who knew where and when to introduce a booster charge of coke the practice was satisfactory, but in recent years the practice has been discontinued in the majority of instances. Straight and uniform charging has been adopted almost uniformly to meet the higher requirements of customers in the chemical and physical properties of their castings. That procedure gives more accurate control.

Another feature which prevents us from presenting a definite opinion on the cause of the excessive burning of the bricks—provided they are bricks and not iron—is that you do not state how long the cupola is in blast. If the heat lasts only for the usual hour or hour and a half, the brick lining at the melting zone with a daubing of good mud every morning should last for a year or more. In some instances a contributory cause of rapid burning is to keep the blast on when the cupola is nearly empty. The blast should be reduced or shut off near the end of the heat when the melting zone is partly or completely exposed.

Chromium-Molybdenum cast iron cuts die costs

In addition to low first cost, good cast iron offers three important advantages for certain kinds of deep drawing and forming dies. Machining costs are lowered; reconditioning simplified; service life increased.

Chromium-Molybdenum (0.30—0.50% Mo) cast iron makes possible maximum benefits. It has the required tensile strength. Its structure permits machining to the necessary smooth surfaces. It can be flame hardened without water quenching. The net result is a sharp reduction in die costs in terms of work produced.

Write for our free technical book, "Molybdenum in Cast Iron".

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS. MOLYBDIC OXIDE BRIQUETTES FOR THE CUPOLA—FERROMOLYBDENUM FOR THE LADLE

Climax Mo-lyb-den-um Company
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MOLY

COMMENT

IN THE mad rush of production and priorities, the foundry industry must not neglect to give some attention to the problems which will arise in the future when the civilian demand for castings once again becomes paramount. Regardless of the present high development in the science of casting metals, the foundry industry as a whole will be in urgent need of the greatest scientific knowledge when that time arrives. Such knowledge can only be obtained through proper attention to the problems of research at the present time.

Just as an example, consider the competitive situation that must result from the tremendous expansion now taking place in the facilities to produce aluminum, magnesium, pig iron, and other metals. This development seems likely to increase greatly the competition between the four branches of the foundry industry. At the same time, plastics and other forms of fabrication will endeavor to expand their markets at the expense of castings.

Therefore, both individual companies and organized groups within the industry should take advantage of the A-2 preference rating recently applied to scientific research by the Division of Priorities of the OPM.

—□—

I regret exceedingly that the information on the "Maintenance and Repairs Rating Plan," represented on this page in the September issue, was obsolete by the time the issue reached its readers. The plan, as outlined, was announced about the time the page was written, but was withdrawn by the Division of Priorities shortly after the issue had been printed. A new order then was prepared but certain changes were decided upon in that plan. Finally Preference Rating Order No. P-22 covering "Repairs" was issued on September 9.

The new order is a much more streamlined effort than the previously announced plan. As outlined on page 108 of this issue, the new repairs plan—Preference Rating No. P-22, provides for repair parts for 20 classifications including "Metallurgy-plants engaged in the production of metals and alloys." An official interpretation of the order from the Division of Priorities includes foundries in this particular classification.

No application to OPM is necessary to operate under the new plan. In order to apply the preference rating to a delivery of materials, the foundrymen must endorse the following statement on the original and all copies of the purchase order or contract, "Purchase Order for Repair or Emergency Inventory—Preference Rating A-10 under Preference Rating Order P-22."

This order will solve many difficulties that face the foundry industry in connection with the procurement of emergency repair parts.

—□—

Foundrymen interested in obtaining further information on the subject of priorities should be interested in knowing that a transcript of the priorities conference held August 26 by OPM for trade magazine and newspaper representatives now may be secured from the Division of Information, Room 5525 New Social Security Bldg., Washington.

—□—

Since foundrymen frequently find the steel warehouse an important source for the supply of a variety of iron and steel metals, the industry should be interested in knowing that the Division of Priorities recently granted a Preference Rating of A-9 for the delivery of steel to warehouses buying directly from the producer. It is to be hoped that this order will solve many of the difficulties which have faced warehouses in recent months and that a satisfactory stock of metals may be carried as an important aid to the national defense effort.

—□—

Shortages of many types of metals has had a direct bearing upon manufacturers of core oil, due to difficulties in obtaining a sufficient quantity of steel drums for shipment of that product. While the supply of raw materials used in the manufacture of core oil is ample, means of handling the oil to the consumer has become difficult. Foundrymen can assist greatly in solving this problem and at the same time assure prompt delivery of core oil if they will hold all core oil drums when empty and return them to the core oil manufacturer for refilling *as requested*. Unless foundrymen will co-operate in this manner it is altogether possible that many foundries will be unable to secure prompt shipment of core oil.

—□—

The following item from the September 15 issue of *Newsweek* should be of interest since it represents the development of an engineer connected with a company producing foundry equipment:

> A revolutionary monocycle engine was test-flown in a Piper Cub at Highstown, N. J., last week, using gasoline with a lower octane rating than regular aviation fuel. Invented by Harry Hedges, an engineer at the Tabor Manufacturing Co. of Philadelphia, the engine features a combustion chamber at each end of its two cylinders so that there is a power explosion for every stroke of the double-headed pistons, compared with only one explosion for each completed upward and downward stroke in a conventional two-cycle engine. There is no carburetor, as fuel is injected through a small nozzle, while intake and exhaust parts in the center of the cylinder are substituted for overhead valves. Hedges claims that, although his model develops only 130 horsepower for its 160 pounds, he could build a 1200-pound motor on the same parts-saving principle that would push out 2400 horsepower. Aeronautical engineers, however, are unanimously skeptical that such an ideal ratio will be achieved for many years. The most efficient engines so far have been unable to beat a 1-to-1 ratio of horsepower to weight.

—□—

The OPM is conducting a survey of vacant buildings suitable for warehouses. During the past few years economic and production trends have resulted in a number of foundry buildings being left vacant in various sections of the country. These might well provide excellent warehouse facilities.

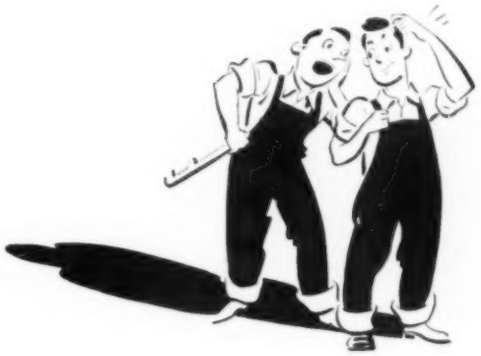
—□—

Reports from Chicago indicate that the annual convention and exhibition of the American Foundrymen's Association, to be held at Cleveland, April 18 to 24, 1942, will top anything yet staged in the history of the association. In addition to a technical program, which will feature a discussion of present day production problems, and the exhibition of equipment and supplies particularly adapted to meeting war demands for castings, the A.F.A. expects to show through an exhibit the part this industry is playing in the production of many types of modern war materiel.

The week in Cleveland should provide both instruction and inspiration for one of the most important of the basic industries. See you there?

F. G. S.

HOW TO KEEP shrinkage cracks OUT OF non-ferrous castings



CORES made with Truline* Binder are just the thing for intricate castings of magnesium and aluminum, because they collapse so fast that there's little chance for core resistance to cause shrinkage cracks.

But this is only one advantage of using Truline Binder in non-ferrous castings. You'll find that sand is easily and quickly removed. Shorter baking time gives you more core oven output.

Convenient-size Bag Is Easy to Handle

And for magnesium: You can bake cores at temperatures as low as 300° F. This means you can put inhibitors right in the mix—instead of spraying on the baked core surfaces.

It all adds up to more sound finished castings, turned out faster at less cost. Clip the coupon to your letterhead and mail it today. We'll see that you get the facts about Truline Binder and a sample if you want it.

HOW TRULINE BINDER INCREASES PRODUCTION IN MANY FOUNDRIES

SAVES TIME ON BAKING Truline Binder bakes through quickly—increasing core oven output. Time saving is sometimes as much as 30%.

SAVES TIME ON CLEANING Cores collapse quickly; this makes cleaning faster. Some foundries have cut cleaning time 50% with Truline Binder.

SAVES TIME ON RAMMING Flowability of Truline Binder mix speeds ramming, particularly in green sand facings.

*Reg. U. S. Pat. Off. by Hercules Powder Co.

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HERCULES POWDER COMPANY

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Please send ☐ Sample ☐ Information on how to use Truline Binder in casting:

☐ Aluminum ☐ Magnesium ☐ Other Non-Ferrous Work

Name.....

Company.....

Street.....

City.....State.....

JJ-43

MEN OF INDUSTRY

J. M. FRANKLIN, manager of the Southern plants, Central Foundry Co., operating foundries in Holt, Bessemer and Anniston, Ala., recently has been elevated to vice president and a director of the company. Mr. Franklin, a native of Birmingham, attended the puolic schools in that city, and Alabama Polytechnic Institute, Auburn, Ala. After serving as an officer in the World war, Mr. Franklin became associated with the Birmingham Machine & Foundry Co., and in 1926 joined the Holt, Ala., plant of the Central Foundry company as assistant superintendent.

♦ ♦ ♦

CLIFFORD W. HOCKMAN recently has been appointed superintendent to erect, equip and then operate the new gray iron foundry of the Bahan Textile Machinery Co., Greenville, South Carolina. For the past three years he has been superintendent of the Peerless Foundry, Cincinnati and before that for several years was superintendent of the Parker-Street Castings Co., Cleveland.

♦ ♦ ♦

WILLIAM A. ROGERS, co-founder of the pig iron firm of Rogers, Brown & Co., Buffalo, which firm still survives as Rogers Brown-Lavino Co., celebrated his nintieth birthday Sept. 8 with relatives at the home of his daughter Mrs. R. D. Hillis, Christmas Cove, Me. Friends in the iron and steel industry sent him a basket of more than 250 letters expressing their regard for him. Mr. Rogers retired from business 15 years ago but goes to his office in Buffalo regularly to attend to his private affairs. At one time Rogers, Brown & Co. were rated the leading pig iron distributors in the world.

♦ ♦ ♦

J. A. BOWERS, melting superintendent, American Cast Iron Pipe Co., Birmingham, has been elected chairman of the Birmingham District Chapter of the A. F. A. Mr. Bowers is a graduate of Central high school, Birmingham and studied foundry practice, chemistry, metallurgy and English at vocational schools and through correspondence courses. He served a patternmaker apprenticeship and worked as a patternmaker several years. He then transferred to foundry work and after molding several years served in the following capacities: Pattern shop foreman, engineering department, personnel work, foreman in research department, cupola foreman and finally his present position as melting superintendent. For the past year he also served in the capacity of apprentice supervisor. Mr. Bowers has been a member of the American Foundrymen's Association refractories program committee and acted as chairman the past year. He also was appointed to serve one year on the apprentice training committee. Prior to being elected chairman of the Birmingham Chapter, he has served as secretary-treasurer and vice chairman. Mr. Bowers also is a member of the Engineers' Club of Birmingham.

♦ ♦ ♦

GORDON LEFEBVRE, Auburn, N. Y., recently was elected vice president and general manager, Cooper-Bessemer Corp., Mt. Vernon, O. Mr. Lefebvre and LAWRENCE F. WILLIAMS have been elected directors.

♦ ♦ ♦

L. W. MOORE, formerly manager of the pipe department, Crane Co., Chicago, has been appointed general purchasing agent to succeed D. G. Park, vice president of purchases who has retired.

♦ ♦ ♦

ROBERT DEWEY, formerly associated with Charles O. Parker Co., Denver, Colo., has joined the staff of the Wadsworth Testing Laboratory, Wadsworth, O. Mr. Dewey is a graduate of Colorado university.

♦ ♦ ♦

DR. H. W. GILLETT, chief technical advisor, Battelle Memorial Institute, Columbus, O., has accepted the invitation of the Institute of British Foundrymen to present the fifth Edward Williams lecture in

(*Continued on page* 76)

J. A. Bowers

William A. Rogers

Clifford W. Hockman

J. M. Franklin

AMERICA FIRST!

WOODWARD Iron Company shares the pride of patriotic foundrymen throughout the Nation in the increasingly important part which products of pig iron are playing in America's defense program.

Recognizing our responsibility, we at Woodward are exerting an all-out effort to produce every possible pound of uniform pig iron and thus fulfill our part of the vital task placed on us by the national emergency.

But while working full speed ahead to meet the extraordinary problems presented by the *present,* we are also looking to the future, when the co-ordinated efforts of American industry shall have won a *certain* victory.

After the war—after the victory—we at Woodward confidently expect to be making pig iron for the 100 year future life of our ore reserves. And when the war is won, we confidently expect to give you, our valued customers, better service and better pig iron than ever before. In the meantime, our thanks for your understanding attitude and your cooperative spirit in helping us fulfill our obligation to AMERICA FIRST!

WOODWARD IRON COMPANY

WOODWARD, ALABAMA

America's Largest Completely Integrated and Entirely Independent Merchant Iron Producer

INDEPENDENT SINCE 1883

(*Continued from page 74*)

1942. He is the first American, in fact the first outside of Britain, to be so honored. The lecture was founded by C. E. WILLIAMS of South Wales, an institute past president, and until outbreak of war was presented annually.

♦ ♦ ♦

E. C. BUMKE who was elected chairman of the Michiana Chapter, A.F.A. is superintendent of the malleable division, Oliver Farm Equipment Co., South Bend, Ind. He was born in Manistee, Mich., and was graduated from the high school of that city in 1920. Mr. Bumke attended the University of Michigan, Ann Arbor, Mich., and was graduated in 1925 with a degree of bachelor of science in mechanical engineering. After graduation he became connected with the Union Malleable Iron Co. division, Deere & Co., Moline, Ill., serving in the foundry, time study department and as master mechanic. Later he was assistant foundry superintendent, Emerson-Brantingham Corp., Rockford, Ill. In 1934 Mr. Bumke became connected with his present firm.

♦ ♦ ♦

A. C. ZIEBELL, president and treasurer, Universal Foundry Co., Oshkosh, Wis., has been elected to serve as president of the Wisconsin Chapter of the A. F. A. for the coming year. Mr. Ziebell, after completing a 4-year training course in pattern-making, and mechanical drawing and engineering, was placed in charge of the pattern shop, then engineering and finally became superintendent of the Termatt-Monahan Co., Oshkosh. Mr. Ziebell was one of the organizers of the Gray Iron Institute, now the Gray Iron Founders' Society and served as a director of that organization from 1933 to 1936. During the past few years he has been devoting time and effort to employer-employe relations and public relations, and in that connection is serving as president of the local chamber of commerce and as a member of the committee on healthful working conditions of the National Association of Manufacturers. Mr. Ziebell has been active in the affairs of the Wisconsin Chapter serving as chairman of the program committee in 1938, secretary in 1939 and vice president in 1940.

♦ ♦ ♦

NORMAN B. CLARKE, recently elected chairman of the Ontario Chapter of the A. F. A. is assistant superintendent of blast furnaces and coke ovens, Steel Co. of Canada Ltd., Hamilton, Ont. Mr. Clarke graduated from Case School of Applied Science, Cleveland in 1918, after which he went into the air service in World War I. From 1919 to 1929 he was connected with the American Steel & Wire Co., Cleveland, and at the time he left the company was assistant superintendent of the open hearth department, Newburg Steel Works. Mr. Clarke then joined the Steel Co. of Canada in Hamilton as assistant superintendent of blast furnaces, and since 1935 has held the position of assistant superintendent of blast furnaces and coke oven departments.

♦ ♦ ♦

HOWARD M. HUBBARD has been elected president, Elliott Co., Jeannette, Pa., manufacturer of power plant equipment. Mr. Hubbard formerly was president, Greenfield Tap & Die Corp., Greenfield, Mass.

♦ ♦ ♦

J. H. B. MCCARTHY, director of industrial relations, Oliver Farm Equipment Co., South Bend, Ind., has been named a panel member for that district of the Training Within Industry section of OPM.

♦ ♦ ♦

J. L. HOLLOWAY has been elected vice president in charge of finance, Crane Co., Chicago. Mr. Holloway joined the organization in 1935, was elected secretary in 1937, and in addition was appointed assistant to the president, which positions he held until the present. W. H. WINSLOW JR. has been elected secretary. He has been connected with the company since 1939 and has handled tax and legal matters. He has been assistant secretary since 1940.

♦ ♦ ♦

JOHN H. COLLIER, president, Crane Co., Chicago, has been elected to the board of trustees, Illinois Institute of Technology, Chicago, to fill the vacancy created by the death of C. B. Nolte, late president of the Crane company.

♦ ♦ ♦

NAAMAN H. KEYSER has joined the research staff at Battelle Memorial Institute, Columbus, O., and has been assigned to metallurgical research. He is a graduate of Antioch college, Yellow Springs, O., and a member of the American Society for Metals.

♦ ♦ ♦

OSCAR E. HESSE has been appointed secretary-treasurer, Logan Engineering Co., Chicago. He succeeds J. I. MCTAGGART who resigned to become secretary-treasurer, C. P. Clare & Co., Chicago. Mr. Hesse formerly was associated with the Knight Soda Fountain Co., Chicago.

♦ ♦ ♦

W. E. SAULT, assistant to the general purchasing agent, and F. H. JANKE, treasurer, American Brake Shoe & Foundry Co., New York, were guests of honor at a luncheon given by WILLIAM B. GIVEN JR., president, to celebrate their fortieth anniversary with the firm.

♦ ♦ ♦

E. C. MADSON has been elected chairman of the newly organized Twin City Chapter of the A.F.A. Mr. Madson, manager of the foundry division, Anderson Foundry Co., Bayport, Minn., received his education in the public schools of Stillwater, Minn., and graduated from high school in 1922. He then became connected with the Anderson Corp., Bayport, in the lumber division of that organization. In 1930 he was made manager of the foun-

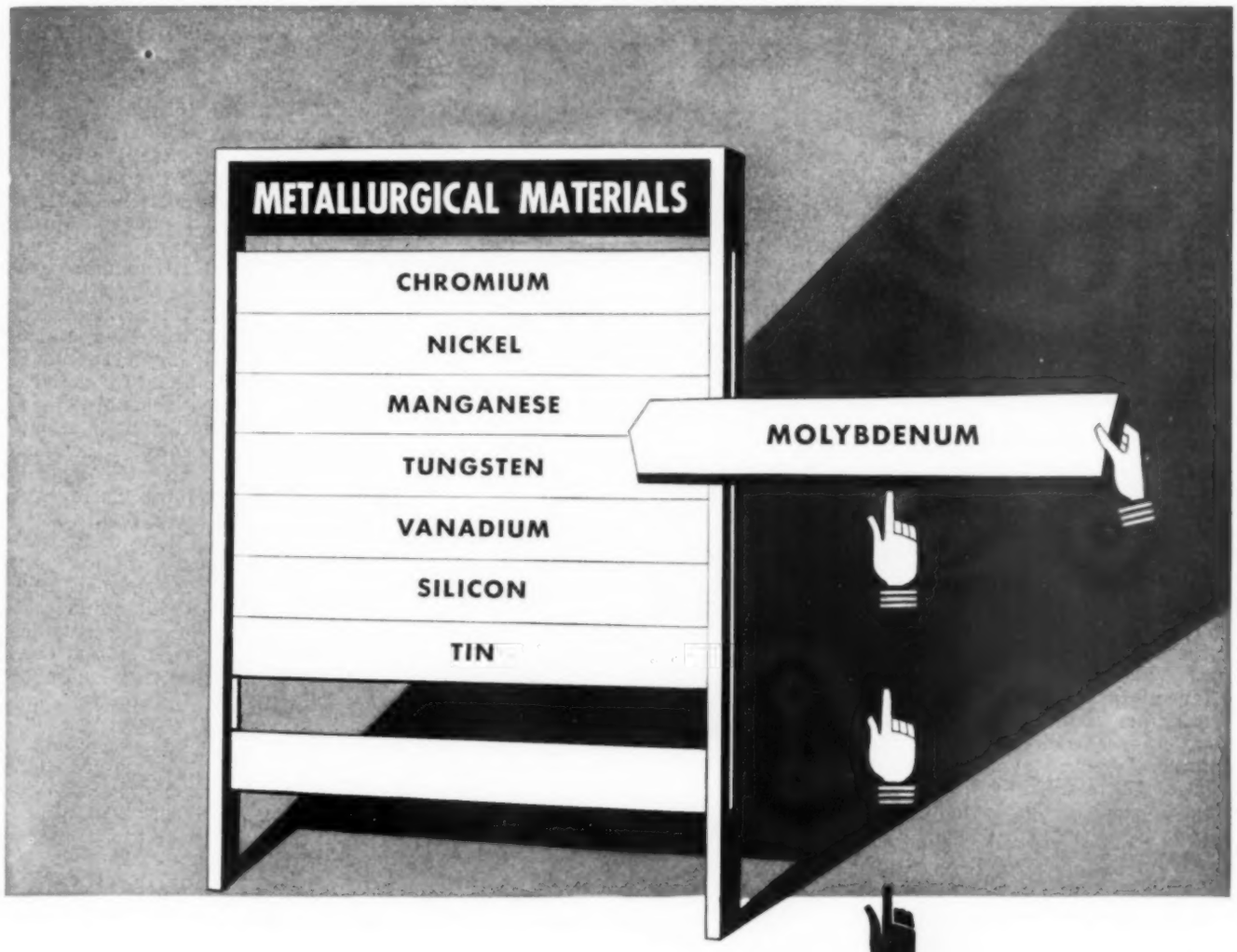
(*Concluded on page 78*)

E. C. Bumke

N. B. Clarke

E. C. Madson

A. C. Ziebell



MOLYBDENUM moves up!

AMERICAN Production, American Distribution, American Control—Completely Integrated

Mines: Tucson, Arizona; Questa, New Mexico.

Smelting and Refining Works: York, Pa.; Washington, Pa.

Offices and Warehouses: Pittsburgh, New York, Chicago, Detroit, Los Angeles, Montreal.

Sales facilities, technical advice, ample stocks available.

Having risen steadily in the scale of importance for years, Molybdenum is now suddenly shifted much higher. Two conditions bring this about. One is new knowledge of the adaptability of Molybdenum for widely varying needs. The second is a temporary shortage of supply, or governmental restriction of use, of other standard alloying elements. Molybdenum is under no such limitation. Tungsten, manganese, nickel, chromium—many specifications for high-grade irons and steels are being rewritten to conserve one and another of these elements, and Molybdenum is replacing them, altogether or in part, without loss of essential quality. Thus production is being speeded at a critical time. Literature and technical advice are at the command of any manufacturer on request. Orders or inquiries will receive prompt attention.

MOLYBDENUM CORPORATION OF AMERICA

Visit Booth E 42 at National Metal Congress

GRANT BUILDING, PITTSBURGH, PA.

MCA

(*Concluded from page 76*)

dry division of the corporation, the Anderson Foundry Co., which manufactures sash pulleys. Mr. Madson was active in the work of the Twin City Foundrymen's Association, serving as a member of the executive committee for six years and as vice president.

♦ ♦ ♦

B. E. MIDDLETON, formerly Chicago representative, McKenna Metals Co., Latrobe, Pa., has been appointed representative in the central New York territory with headquarters in Rochester, N. Y.

♦ ♦ ♦

R. A. FREEMAN, president, York Foundry & Engine Works, Inc., York, Nebr. has been appointed one of an advisory board of seven to serve in bringing about the efficient operation of industries in Nebraska that may be allied with the progress of national defense.

♦ ♦ ♦

HENRY A. STROW has been appointed chief chemist, MacDermid Inc., Waterbury, Conn. Mr. Strow after graduation from Purdue University was employed by the Udylite Corp. as research chemist and more recently as maintenance service engineer, Detroit Transmission division, General Motors Corp., Detroit.

♦ ♦ ♦

R. M. MARSHALL has been elected chairman of the board, Kerchner, Marshall & Co., Pittsburgh, at a special stockholders' meeting occasioned by the death of L. S. Kerchner. W. A. BROWN was elected president, E. E. GAUB, vice president and secretary, and MARGARET C. NEDAMYER, treasurer.

♦ ♦ ♦

WILLIAM B. GIVEN JR. has been elected president, National Bearing Metals Corp., New York, to succeed J. B. STRAUCH who has been elected chairman of the board, the position previously held by Mr. Given. Mr. Given also is president, American Brake Shoe & Foundry Co., which owns a controlling interest in the National Bearing Metals Corp.

♦ ♦ ♦

E. E. WARE, vice president, and for many years technical advisor to the president, Sherwin-Williams Co., Cleveland has been placed in charge of that company's new ordnance plant, Illinois Ordnance Works, to be built at Marion, Ill. Mr. Ware is a member of the Cleveland district committee of the American Society for Testing Materials.

♦ ♦ ♦

PALMER E. HANSON, for the past 12 years secretary, Milwaukee Automotive Trades Inc., has been made assistant to the works manager, Mack Motor Co., New Brunswick, N. J. Mr. Hanson will be active in the foundry department. At one time he was superintendent of the Buick Motor Co. foundries at Flint, Mich., and later was with the Lakey Foundry & Machine Co., Muskegon, Mich.

♦ ♦ ♦

LEMONT ROMMEL has become connected with Gillett & Eaton Inc., Lake City, Minn., as foundry foreman. Mr. Rommel served an apprenticeship with the J. I. Case Co., Racine, Wis., starting in 1910. In 1919 he was promoted to the position of core room foreman and in 1926 was transferred to the company's plant at West Allis, Wis., serving as assistant foundry foreman. In 1931 he returned to the Racine plant as foundry foreman. When the J. I. Case Co. bought its Rock Island plant in 1937, Mr. Rommel was assigned to open it and start operation, serving as foundry superintendent.

Lemont Rommel

♦ ♦ ♦

R. N. MCADAMS, assistant secretary and assistant treasurer, Hercules Powder Co., Wilmington, Del., was elected secretary. Mr. McAdams fills the vacancy caused by the death of H. F. SMITH. WILLIAM R. STEVENS, credit manager, was elected assistant treasurer, and GEORGE B. BAYLIS, who has been connected with the treasurer's office, was elected assistant secretary. JOHN B. LODGE, assistant credit manager has been appointed credit manager.

Simplify Radiators

A revision of the simplified practice recommendation on large-tube, cast-iron radiators just has been approved and becomes effective on Oct. 1. It is identified as Simplified Practice Recommendation R174-41, and copies may be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington. The copies are in mimeograph form, and are free to those interested.

To Discuss Defense At Metal Congress

The twenty-third National Metal Congress and Exposition to be held in Philadelphia for five days beginning Oct. 20 will be headlined by a series of important national defense group meetings on defense problems, conservation and substitution according to W. H. Eisenman, managing director of the exposition and secretary of the American Society for Metals. Thirteen special defense meetings will present more than a hundred specialists actively engaged in either industrial defense activities or government planning in the present emergency. Sessions will be held during late morning, afternoon and evening during the five days of the exposition.

Topics include: Shell steels, forgings, castings, spun process, heat treatment, sand blasting, machining and cartridge cases; aluminum castings and their heat treatment, and magnesium castings; iron and steel alloy castings with discussion of the functions of nickel, chromium and vanadium that are scarce; the function of manganese that is probably obtainable, function of molybdenum, copper, silicon, titanium, phosphorus that are more plentiful; utilization of classified scrap and alloy pig iron; ultimate conservation due to over-all economies of stronger and more machinable and more durable metal; and situations in various industries including automotive, railroad, mining, power, chemical and petroleum, machine tools and agricultural machinery.

To Preview Exhibit

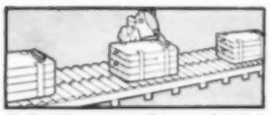
The Carborundum Co., Niagara Falls, N. Y., will hold a dedication and preview of its educational exhibit, telling the story of modern manufactured abrasives, which has been installed at the Museum of Science and Industry, Chicago. Ceremonies will be held Oct. 16, beginning with a reception at Hotel Windermere, where the guests will be received by the president of the Carborundum Co., Dr. Frank J. Tone, vice presidents Charles Knupfer and Henry P. Kirchner, secretary Arthur Batts, treasurer, F. H. Manley, and sales managers F. J. Tone Jr., and E. R. Newcomb.

Training Within Industry Branch, Labor Division, OPM, Washington, recently has published two bulletins entitled, "Manning an Airplane Engine Manufacturing Plant With 10,000 Employes," and "Upgrading and Full-time Instructors Solve Problem of Expansion in Precision Manufacture."

MANY HAPPY "RETURNS"!

THE answer to 100% speed in production.... is *100% returns* from machines, equipment and men. And this can be accomplished best when (1) machines operate without delays, (2) equipment is used continuously, (3) men are free to exercise skill with no time-out for tiring fetch-and-carry duties.

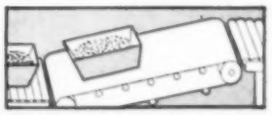
Because Logan Conveyors are a major factor in arriving at *all three* of the above aims, this modern aid to the foundryman is bringing many happy returns to foundries nation wide. What are *your* needs in sturdy Roller Conveyors, or other types? The Logan plant is busy, but facilities for the handling of foundry conveyor orders have been augmented recently. Phone or write LOGAN, 580 Cabel, Louisville, Ky.



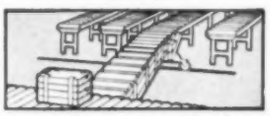
Roller Conveyors—basis of most installations, see many uses shown in Bulletin 15.

Transfer Cars—for "effortless" transfer of molds or tote pans from one line to another.

Turn-Tables—change direction of travel in minimum space. Molds or tote pans.



Belt Conveyors—used as boosters in roller lines handling tote pans.



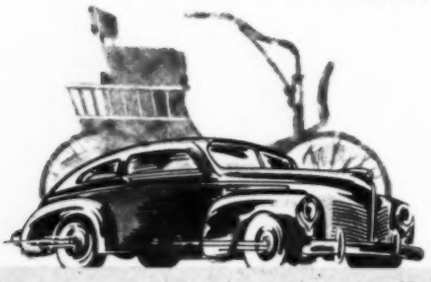
Apron Conveyors—used where power conveyor required. Various applications.

Roller Spirals—for "vertical" lowering of tote pans of castings. See Bulletin 15.

LEFT: *Logan bearings are three-point type. Inner races broached to hexagon shape for slip fit on shafts. BELOW: Battery of Logan heavy duty Roller Conveyor pouring lines. Molds move on to shakeout, castings conveyed through machining, flasks return to molding machines.*

Logan Conveyors

ADVERTISING PAGES REMOVED



By A. H. ALLEN
Detroit Editor, The Foundry

AMONG DETROIT FOUNDRIES

ALTHOUGH formal announcement had not been made as of Sept. 15, trade circles have reported plans for an important new addition to foundry facilities at the Ford Motor Co. which already operates one of the largest foundries in the world.

A steel foundry, the new plant will be two stories in height and will provide an estimated 350,000 square feet of floor space. Piling is now being driven for foundations and tentative orders placed for much of the equipment, awaiting only the formal assignment of a priority number to get the go-ahead. This was believed to be a routine matter inasmuch as the plant apparently will produce defense equipment castings almost entirely.

Use Triplex Process

Feature of the melting process to be used is that it the so-called triplex type, involving combination of cupolas, bessemer converters and electric furnaces, similar to the set-up now in production at Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., where a variety of comparatively small castings, both defense and automotive, is being cast on a continuous, conveyorized basis, using the combination melting practice.

The Ford plant is being designed for four 96-inch hot blast cupolas, four 4-6 ton sideblow bessemer converters and six 12-ton Swindell-type electric furnaces. Normal production of around 30 tons per hour, or a maximum of 45 tons an hour, is being planned, indicating probable operation of two cupolas at a time, since this size cupola will provide about 23 tons of hot metal an hour.

Cupolas charges will comprise steel scrap mainly—bundles, briquetted borings, turnings, plant scrap—along with some pig iron. This will be melted down conventionally to an iron with about 3.25 per cent carbon, which will be transferred to the bessemers and blown down to around 0.35 per cent carbon, and finally placed in the electrics for recarburizing, refining and superheating, before casting.

In this connection, observers point out that C-W-C has experienced difficulty in holding carbon content within the 0.20-0.50 per cent range in the bessemer, so has changed practice to blow the iron down until the yellow carbon flame recedes into the mouth of the converter or until content is down to around 0.10; then recarburizing in electric furnaces.

There is the added problem of phosphorus and sulphur which must be kept low if suitable steel is to be obtained for casting, particularly centrifugal castings of the type to be produced in the new Ford plant. Although it is possible to desulphurize and dephosphorize steel in the ladle, it is said to be difficult to dephosphorize unless carbon content is very low. The suggestion is voiced that Ford may be planning to use basic-lined bessemers instead of acid bessemers, in which case it would be possible to pull down sulphur and phosphorus in the converter.

Want Low Phosphorus

With cupola charges a large part steel scrap, it might be thought that phosphorus content would not be overly high anyway, but it is stated that even the regular open-hearth steel is too high in phosphorus for the type of steel wanted, in which case steel scrap would carry through this phosphorus content to the end, unless removed in the converter or in the ladle. Difficulty in obtaining low-phosphorus pig iron is another factor which would tend to push up phos content in the cupola iron going to the converter. Chances are that arrangements will be made in the converter stage of the process to bring the phos down to desired limits.

No definite information has been gleaned on what products will be turned out in the new foundry, but two possibilities suggest themselves. One is a centrifugally cast cylinder barrel for the Pratt & Whitney aircraft engine which Ford is rapidly getting into production. Forged steel barrels have been used right along, but Ford tests with the centrifugally cast barrel have shown important advantages. In the first place, the amount of machining needed on the cast barrel is far less than that on the forging. In the second place, the cast barrels have shown bursting strengths considerably in excess of the forgings. And in the third place the castings have shown more consistent uniformity. At recent lot of 24 cast barrels passed all tests with flying colors, except for one barrel. This is considered a better showing than possible with routine production of forged barrels.

The Air Corps has O.K'd the production of 500 engines with cast steel barrels at the Ford plant. Each engine requires 18 barrels which weigh in the rough something like 30 pounds each.

Cast Landing Gear

Another possibility is airplane landing gear struts or hinges which Ford has produced experimentally by centrifugally casting. These are to be used on the Consolidated B-24-D bomber which Ford is tooling to produce in a vast new plant at Ypsilanti, Mich., and are heavy pieces weighing probably around 75 pounds. It is likely, too, that experiments have been run on numerous other parts, some heavier than these items, but at least these two have been displayed publicly by Ford engineers.

The new foundry project ties in closely with the whole Ford ferrous metal producing picture and may be classed as more of a solution to the raw materials problem than as strictly an expansion of capacity. This sounds somewhat paradoxical, but it should be remembered that the two Ford blast furnaces are coming in for a pinch as the demand for iron bulks up. This pinch has been felt before, as recently as 1937, when plans matured for a third blast furnace which ultimately was held in abeyance. It is possible work may soon go ahead on this furnace although its completion would be a long-time proposition, whereas it is hoped to have delivery of the foundry equipment in six months from the official awarding of priority, and installation com-

(*Concluded on page* 84)

REPEAT ORDERS

Keep us Busy!

SPEEDMULLOR production line in The Beardsley & Piper Co. plant. Most *SPEEDMULLOR* installations are replacing conventional type mills.

One customer buys 6 for a magnesium foundry

Customer satisfaction is the supreme test of any foundry equipment—especially when the names of those customers are familiar to every man, woman and child in America.

SPEEDMULLOR Capacities

Models	*Tons per Hour*	*Models*	*Tons per Hour*
No. 10 (laboratory)		No. 60	65
No. 30	20	No. 70	90
No. 40	33	No. 80	125*
No. 50	50		

**Up to 156 tons per hour on Magnesium system sand.*

Ask a SPEEDMULLOR User!

THE BEARDSLEY & PIPER COMPANY 2541 NORTH KEELER AVENUE CHICAGO

ADVERTISING PAGES REMOVI

(*Concluded from page* 80)

pleted shortly thereafter.

The foundry building will be located at the south end of the present open-hearth plant, and at right angles to it. Tracks will interconnect the two plants, and eventually there may be more co-ordination of the two than is contemplated immediately. For example, it is reported that studies have been made of enlarging open-hearth capacity, including the installation of more basic furnaces and the possible inclusion of some 25-ton bottom-blow bessemer converters which would be integrated with open hearths to speed up melting time for heats of steel by a duplexing method.

Another "still on paper" project which may eventually become an actuality in the Ford industrial metropolis is an aluminum foundry. Layouts have been prepared of such a plant, running to something like $2,000,000, but of course, much can happen between the layout stage and the building stage.

With all the motor car manufacturers now in production on 1942 models, their fingers crossed on how long they can continue present versions of these models, it is interesting to observe reactions to cast iron pistons, new in several makes because of the shortage of aluminum alloys. Manufacturers like Ford, Chevrolet and Pontiac strike the attitude of, "We knew all the time that cast iron (or steel) was the best material, and have used nothing but that."

Others, like the General Motors divisions, Chrysler lines and Studebaker infer that, "new pistons designs permit the use of iron with no sacrifice in performance, in fact maybe a little bit better with the iron." Still others, such as Nash and Packard, say, "We're still using aluminum and will continue to do so as long as the supply holds out; but we have all ready designs for iron pistons that are every bit as good."

One auto executive is quoted as saying that after driving one of his 1942 cars in which cast iron pistons replaced aluminum, the engine appeared to be smoother running at high speeds and sacrificed nothing in performance. So successful were the new pistons that it is doubtful if this company ever will return to aluminum. Another official says scuffing of rings and cylinders is greatly reduced with cast iron pistons.

Against these viewpoints are heard occasional charges that iron pistons result in higher oil consumption, and that some breakage has been encountered.

The gage of any return to aluminum alloy pistons will be availability of the metal and its ultimate cost. The current enormous expansion of the aluminum industry suggests that before long there is going to be so much aluminum available that it may go begging, and at a price per unit of volume that will give even plain cast iron a merry battle.

C. L. McCuen, vice president in charge of engineering, General Motors Corp., in a recent address to newspaper men told them the corporation had two alternate piston materials in cases where aluminum shortages necessitated a change. One was gray cast iron, which ran about 84 per cent heavier than the same piston in aluminum, and Arma-steel, which ran about 42 per cent heavier. Arma-steel is a pearlitic malleable iron produced at the Saginaw Malleable Division of the corporation. Because of its higher strength, it can be cast in thinner sections than gray iron. This is the same story as that pertaining to the Ford steel piston, except that because of the higher strength of the Ford alloy it can be cast in sections which make the finished weight almost identical with the same piston in aluminum.

READER'S COMMENT

Readers are invited to comment upon articles and other editorial material appearing in THE FOUNDRY. *The editors cannot publish unsigned communications, but at their discretion may permit a writer to use a pseudonym when a bona fide reason exists for withholding his identity. Letters should be brief.*

THE EDITORS

May Be Danger

TO THE EDITORS:

In the May issue of THE FOUNDRY an article entitled "High Lead Bronzes Produced Easily" appeared on page 98 which is probably of much interest to those engaged in production and also to the industrial hygiene engineers whose problem of protecting the health of workers in industry is rapidly becoming more complicated because of developments similar to this.

The Hygiene Division of the Illinois State Department of Labor has been engaged in a study of the lead hazard in brass foundries. While this data is not complete, the information so far accumulated definitely shows that lead poisoning may easily result from exposures during brass foundry operations, particularly in the melting and pouring of lead bearing alloys. In foundry practice, the hygiene emphasis has been placed upon the silica dust hazard. Occasionally, the exposure to zinc fumes, the source of "zinc chills" has been the subject of investigation and comment. Little appears in current literature or even in comprehensive standard works on occupational disease with reference to the possibility of lead poisoning.

It is quite probable that lead poisoning is far more prevalent in industry than is generally suspected. The symptoms are quite variable and few general medical practitioners are sufficiently versed in occupational disease to discover the true source of symptoms which resemble a variety of organic diseases.

At the present time, there is a shortage of skilled foundry labor and it seems obvious that every safeguard should be employed to prevent exposure of men to lead concentrations in air which may cause incapacity. Aside from any humanitarian considerations, it is good operating practice.

Properly exhausted or vented furnaces, grinding wheels and sandblasting operations should be the rule in every brass foundry. Pouring should be done under exhaust, if possible; good housekeeping, ample ventilation and proper distribution and intensity of illumination are fundamental to safety and good work.

CLYDE H. MCCLURE,
Chemical Engineer
Department of Labor
Division of Factory Inspection
State of Illinois
Chicago

Preventing Fires

Since National Fire Prevention Week will be observed during Oct. 6 to 11 it may be well to point out that according to John F. Kidde, New York expert, the most serious problem lies in the large number of new employes untrained in proper safety procedure. They should be given easy rules to follow and plenty of instruction posters should be on the walls. Beside each fire extinguisher should be mounted a poster telling exactly what to do with it if fire breaks out. Post instructions near each fire alarm box, and also post signs stating where the nearest box is located.

Instruction sheets should be given to each employe containing such information as type of fire which might be encountered so that danger signals can be recognized, and how to combat them; how to operate fire extinguishers, and what to do in case of small fires; detailed description of turning in fire alarm promptly, and a set of fire prevention rules calling attention to dangerous and safe practices.

Foundry DEVELOPMENTS At Short Range

RECENTLY reported investigation on the freezing points of irons and steels conducted by the National Bureau of Standards, Washington, provides a means of computing initial freezing points which agree closely with those measured. Initial freezing point of pure iron was found to be 1538.9 degrees Cent., and that was depressed by addition of various elements. Effect of carbon in depressing freezing point per percent by weight varied as follows: 65 degrees Cent. at 0 per cent, 70 degrees at 1 per cent, 75 degrees at 2 per cent, 80 degrees at 2.5 per cent, 85 degrees at 3 per cent, 91 degrees at 3.5 per cent and 100 degrees at 4 per cent. Phosphorus depressed freezing point 30 degrees; sulphur, 25 degrees; silicon, 8 degrees; manganese and copper, 5 degrees; nickel, 4 degrees; molybdenum and vanadium, 2 degrees; chromium, 1.5 degrees; aluminum, 0 degree; tungsten, 1 degree; arsenic, 14 degrees; tin, 10 degrees. For example, a cast iron containing 3.76 per cent carbon, 0.54 per cent manganese, 0.46 per cent phosphorus, 0.05 per cent sulphur and 2.10 per cent silicon showed a measured initial freezing point of 1150 degrees Cent. while the computed value was 1147 degrees.

* * *

Castings properly applied always serve satisfactorily notwithstanding the derogatory remarks of the advocates of other types of fabrication. In some cases castings meet undue conditions without turning a hair, and it is a pleasure to point out such examples. This comes from our contemporary across the sea—the *Foundry Trade Journal:* Strength of Malleable C. I. Fittings —During an air raid, a wall was demolished, leaving a pipeline hanging in the air. One long length was joined to another pipe by means of a 1½-in. short pattern female GF bend, but whereas these pipes were originally fitted at 90 deg. the blast blew one pipe round so that the angle was closed to 42½ deg. No sign of fracture either at the radius of the bend or at the threaded joints was observed so as a matter of interest this fitting was blanked off and tested to 360 lb. per sq. in. It remained perfectly tight at this pressure.

* * *

In a recent review of Russian blast furnace practice research, it was mentioned that blast furnace flue dust added directly in the runner during casting of the iron had considerable refining effect. It was claimed that a 4 per cent addition of flue dust increased the iron yield 2.5 per cent and very appreciably reduced the silicon, manganese, carbon and sulphur contents. Also it was said that the addition of flue dust did not lower the temperature of the iron. Those statements seem to have possibilities in the foundry for a quick, easy method of securing a low silicon, low carbon iron. Instead of flue dust roll mill scale might serve.

* * *

BRIGHT dipping brass in the usual sulphuric-nitric mixtures generally is accompanied by copious brown fumes which must be removed. In may cases a fumeless dip will serve satisfactorily, and a mixture suggested for that purpose in a British publication contains 65 gallons sulphuric acid, 20 gallons nitric acid, 100 pounds chromic acid, 1 gallon hydrochloric acid and 120 gallons of water. It can be operated without need for elaborate exhaust and absorption equipment. Simple hooding without attention to great air velocity and with delivery to open atmosphere can be tolerated since fuming is slight. The dip gives a bright and uniform color, and also can be used with coppers, bronzes and nickel silvers.

* * *

Progress in new applications for castings is illustrated forcibly by the following material from the Meehanite Research Institute: "Important time and cost savings now are being effected in many machine shops as a result of a recent development in the application of high strength Meehanite metal for sintered carbide tool shanks. A more or less frequent problem, now particularly costly from the time standpoint, has been the breaking of tool shanks on multiple tool heavy duty lathes." The item goes on to say that vibration damping qualities of the metal absorbs vibratory stress, reduces tool chatter and breakage. Coefficient of expansion of sintered carbide more nearly approaches that of the metal than it does of steel, improving heat conductivity with coresponding reduction of expansion stresses in service. Grinding of the shanks also is said to be more efficient than with steel.

* * *

One cupola authority recommends that the weight of the coke split should be the governing factor rather than the weight of the iron charge. Fuel charge of a cupola may vary from 9½ to 7 pounds per square foot of cupola area, and the iron charge should be 8½ to 12 times the weight of the fuel charge. When the iron charge contains 60 per cent or more of steel scrap, the metal charge should be 8½ times the fuel, while with 10 to 20 per cent or no steel it should be 12 times.

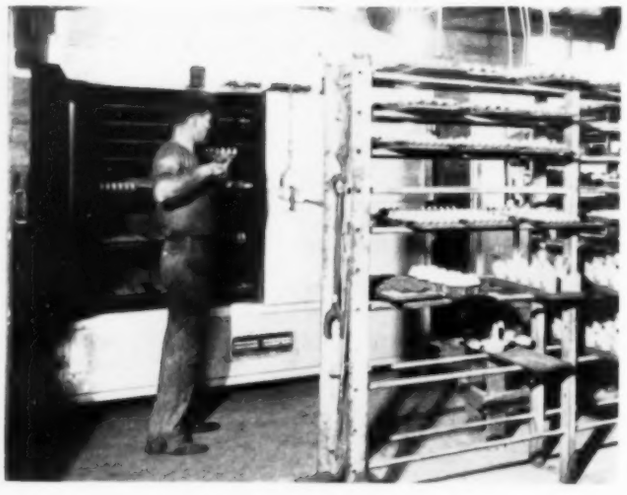
* * *

TO GET the most value from its grinding wheels by preventing operators from turning in wheel stubs which are still usable, one firm has developed a simple, but very effective checking system which can be applied easily at any grinding wheel stockroom. The procedure is to cut a slot in the wall with dimensions limiting the size of wheel which can be admitted. Consequently, when the wheel won't go through the slot, the stock keeper refuses to issue a new one.

1 for 6 MAEHLER CORE OVEN Replaces SIX BRICK OVENS

at Chambers, Bering, Quinlan
Decatur, Illinois

Success of installation brings repeat order for THREE more ovens!



QUICK FACTS ON CABINET OVEN:

7'-1" wide x 6'-10" high x 3'-7" deep.
Two compartments each 37" wide x 48" high. 35" deep.
Used as continuous day oven.
For small cores and rush jobs.

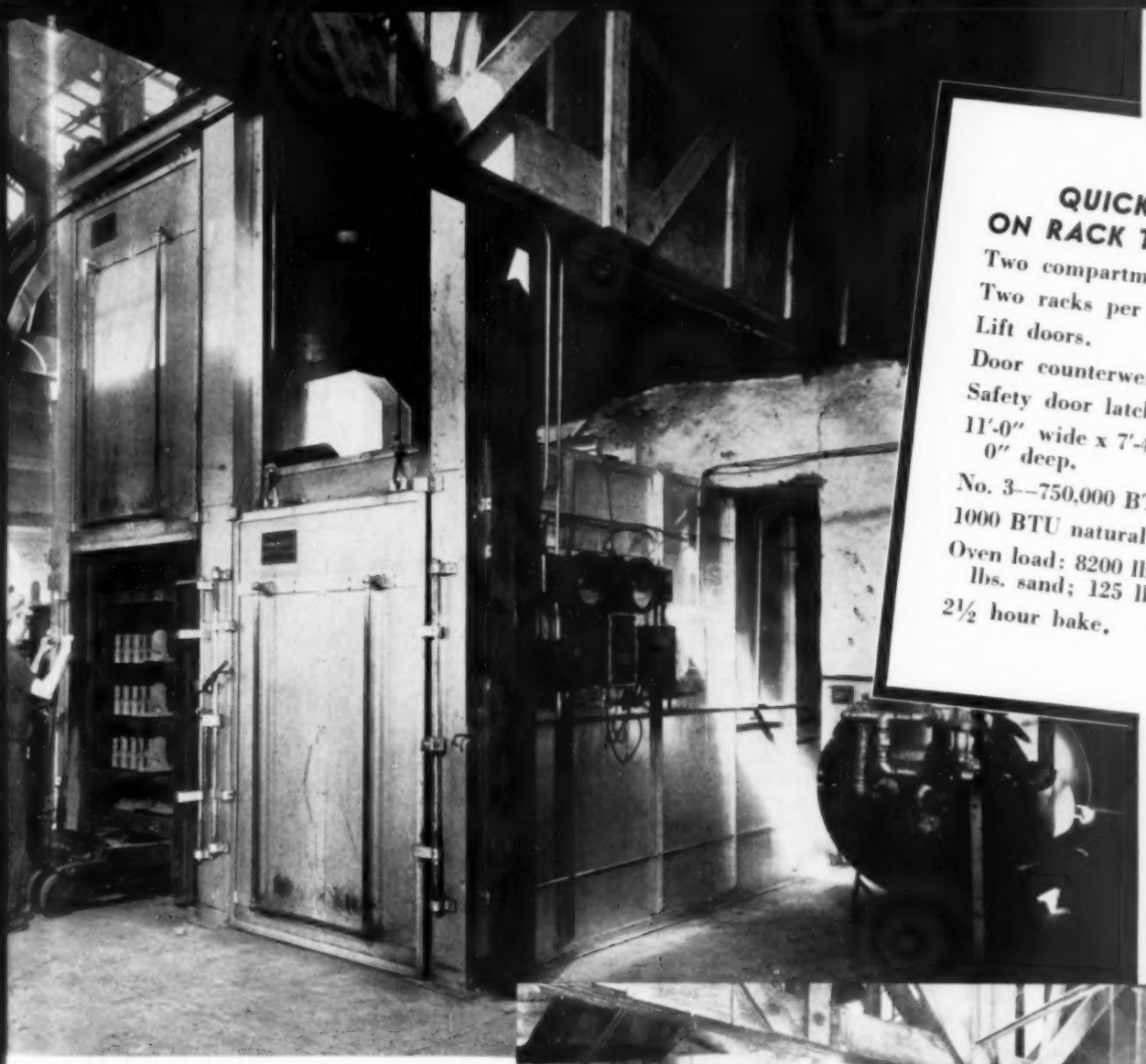
IN 1940, Chambers, Bering, Quinlan bought their first Maehler Recirculating Air Heat Rack Type Core Oven — installed to replace six brick drawer type ovens equipped with internal gas burners. So successful was the installation that since that time this customer has placed repeat orders for two more identical Maehler Ovens and one Maehler Cabinet Type Core Oven!

Maehler Ovens are scientifically designed to produce perfectly baked cores in less time, at less cost and with less floor space than obsolete units.

If you want to speed up work, keep a steady flow of cores going into the foundry and eliminate the hours and dollars wasted through improperly baked cores . . . end the core room bottleneck with new Maehler Ovens. Details on request. Write Today!

The PAUL MAEHLER

Originators of Recirculating



QUICK FACTS ON RACK TYPE OVENS:

Two compartments.
Two racks per compartment.
Lift doors.
Door counterweights enclosed.
Safety door latches.
11'-0" wide x 7'-4" high x 14'-0" deep.
No. 3—750,000 BTU heater.
1000 BTU natural gas for fuel.
Oven load: 8200 lbs. steel; 2500 lbs. sand; 125 lbs. water.
2½ hour bake.

These are the PLUS VALUES:

Here's how Chambers, Bering, Quinlan profited from Maehler Ovens:

- Six for one!
- Shorter baking time!
- More uniform bake!
- Cut loss of cores by burning to zero!
- Increased working space in core room!
- Reduced heat and gas in core room!
- Reduced working hazard through safety equipment on ovens!
- Made possible record high production!
- Made possible accurate control over each oven compartment!

COMPANY

2200 W. LAKE ST.
CHICAGO, ILLINOIS

Air Heat Industrial Ovens

THE ADVENTURES OF BILL

BY PAT DWYER **Drawings By RICHEY**

THE other day," said Bill, "Tuesday or Wednesday, I forget which or maybe it was Thursday—I kinda got mixed up during vacation time—you know how it is—well anyway at the noon hour, I was sitting at the two-party table absorbing the customary allowance of corn beef and cabbage. A portly gent came along and courteously inquired if I was expecting company. If not he would use the other half of the table. Not to be outdone in the old entent cordiale and all that kind of stuff I drew an imaginary line across the center of the table and told him to go as far as he liked provided he kept his paws out of the dishes on my side. He gravely thanked me for the cordial and whole hearted welcome, sat down opposite me and plied knife and fork in a highly creditable and workmanlike manner. I like to watch a skilful performer in any line and although my natural modesty prevented any actual comment, he probably noted the beam of approval I cast upon him occasionally. He ventured a brief remark about the excellent quality of the food. Assuming for the moment the doddering voice and manner of the traditional oldest inhabitant I assured him that as man and boy for over twenty years I had eaten the noon day lunch at this place. He said ha, ha, that was a good one and he was sure the manager would be glad if I put it in writing."

"Don't tell me," I said. "Let me guess. The portly gent was the manager."

"You are the third sucker I have hooked on that one today," Bill remarked complacently, "I'll have to bait the hook and cast it overboard again. No, my boy, he was not the manager. Somewhat to my surprise I learned that he was, or is, a lawyer. His hobby for the past 30 years has been writing little essays and stories for various publications. He pulled the manuscript for one out of his pocket, piping hot you might say off the griddle. All about a fella who noticed that his young son laid on floor with his nose buried in one of these here now alleged comics, totally unconcious of a radio in the immediate vicinity where a man with a raucous voice told the world about himself and his—the radio fella's—sister. Come to find out, the kid had rubber stoppers in his ears. The father tried them, and believe it or not, he could hear absolutely nothing. The moral of the lesson was that here was an opportunity for some person with a little capital to get into the business of manufacturing an article for which a practically unanimous demand already exists. In addition to conferring a boon on suffering humanity, this party of the second part would collect a pile of Jack and live happy ever afterward."

Old boy springs Ancient Mariner stuff

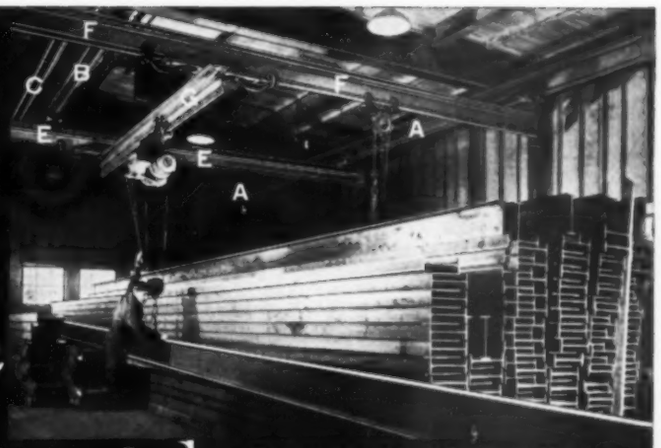
"More likely to collect a pile of headache. Litigants and business rivals would pop out of the ground or the wood work and either take the stuff away from him through a system of legal chicanery or boldly bend a black jack over him some dark night and stuff the body up a chimney. A claimant would be almost sure to arise with proofs that his maternal grandfather Amos Q. Dogberry, up in Vermont, had originated the idea one night while milking the family cow, as slick a Jersey as you ever seen. Used to take prizes at the county fair. Grandpa patented the idea, but never done nothin' with it. Filled with the famous old compound in which vinegar is one of the main ingredients, he shouldered a musket and spent four years, '61 to '65 around Virginia and Tennessee and other foreign places. Finally he and Grant and a few of the boys brought the struggle to a close. When he returned home he was so accustomed to the noise of rifle and cannon that nothing bothered him any more. He is up there now under a great granite slab where wicked boys play cards on Sunday afternoon and occasionally lay a small wager that the old boy will pay no attention when and if Gabriel blows the final trumpet."

"Away back on the long road I knew a young fella who served his time in a little shop up in that part of the country and then hit the road through the usual combination of curiosity, wanderlust, adventure and the desire to perfect himself at the trade. Me and him goes down to the new shop of the G. E. in Schenectady—I was there two months before I could pronounce the word. I never learned to spell it—and get ourselves a job. When he got inside and saw the size of the shop and the size of some of the castings, he got cold feet and told the gaffer he was a coremaker. He was sent to the core room where he whacked out the little ones without any trouble.

"One day the boss gave him a corebox a little larger than those into which he had been packing sand for a week. He was told this was a special core and had to be made from a special core sand mixture, dried at a special temperature, touched up with a file and black washed in a very careful

(*Continued on page* 92)

New AMERICAN MONORAIL Criss-Cross System AIDS PRODUCTION



Criss-cross or 3-level American MonoRail System stores steel taken direct from gondolas. (Letters on equipment correspond with those on layout below.)

Overhead MonoRail serves the punch (and all units) efficiently . . . fully covers the area . . . permits passing of loads . . . moves them easily.

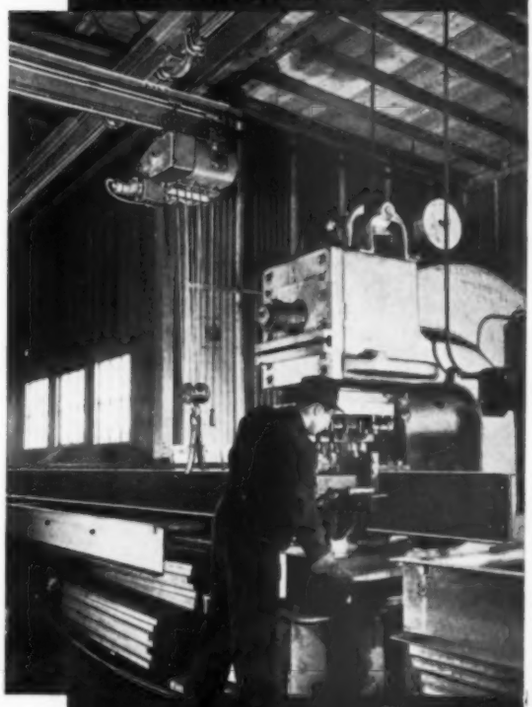
THIS newly developed MonoRail System of rails, cross rails and bridges is a most efficient and economical means of overhead handling in small plants.

With this system you can place the load exactly where you want it—in storage, fabrication or shipment.

By eliminating floor congestion American MonoRail increases plant capacity. By providing superior mechanized methods for lifting and carrying, it increases the productivity of labor. Skilled labor is not required in its use. Operation and maintenance, a minimum. In many plants this low cost, flexible handling system has soon repaid its cost.

Just what saving you can realize can be soon determined by an American MonoRail engineer. Write us about your problem.

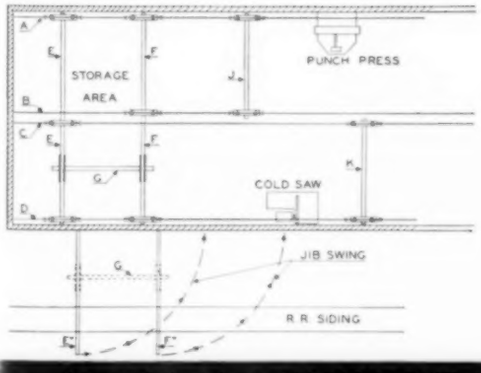
Ask for free copy of "Blue Book" illustrating numerous installations.



In unloading or loading parallel jibs (E' and F' on layout) are swung out from building interlocking with tracks (inside) carrying MonoRail bridge equipped with electric hoist . . . unloads and stores without rehandling.

THE AMERICAN MONORAIL CO.

13104 Athens Avenue Cleveland, Ohio



Layout of shop showing 3-level MonoRail System.

ADVERTISING PAGES REMOVED

(*Continued from page* 90)

manner. When the boss came around for the core, our hero had it in his lap and was applying the black wash with a ½-inch painter's brush. The job was in a hurry, but he was in no hurry. He applied the blacking in streaks and dabs over the surface. Looked like one of these here now modern pieces of art. Every few minutes he would place the core on the bench, step back several paces, cock his head from one side to the other and examine the work of art critically and approvingly. The old man was boiling. Ladle of metal ready, mold open and no core. He restrained himself with great difficulty from the pleasure of laying violent hands on the artist. He became ponderously sarcastic.

"'Ain't I the lucky little feller,' he says, 'I think I am ketching a core maker and I ketch a ready made artist instead. However,' he says, 'judging by the time you have taken to paint that core, I should hate to give you a job painting a house. Just between I and you and with the understanding it don't go no further, how long do you suppose it would take you to paint a house?' The painter inquired innocently if this was a small or large house. To the impatient reply that just for the sake of the argument this was a small house he said that the job would take him practically no time.

"'It wouldn't, eh?' says the ex-sergeant of Marines. 'Here you been all day on a 1-hour job and now you are going to paint a house in no time. I suppose with that toy brush you have in your hand?'

"'Not a-tall' says our hero, 'Not a-tall. If she was small enough I'd dip 'er!'

"Talking about cores," Bill continued, "reminds me of an inquiry from a foundryman who said that he had tried without success to cast a plate 40 x 56 inches, 3½ inches thick with two pipe coils 1 5/16-inch diameter on the inside. High temperature metal melts the pipe. Cold metal produces missruns and dirt. Running water through the pipes chills the metal in the vicinity of the pipes and produces shrinkage areas on the cope side.

"Castings in which steel pipes are enclosed invariably cause trouble where the foundryman is not familiar with certain peculiar features. If the pipe is not perfectly clean and dry, the metal will not lie against it quietly. The kicking and boiling metal produces a mass of foreign material which either floats to the surface or remains scattered throughout the casting. Usually this action is quite apparent where gas, steam and sprays of molten metal are vomited through the risers. In some instances the boiling action ceases before the mold is filled. The iron rises quietly and the foundryman assumes that the casting is satisfactory. When it is shaken out he discovers dirty and shrunken areas. Where the action is particularly violent some of the sand is torn from the cope face with resulting unevenness on the top face of the casting.

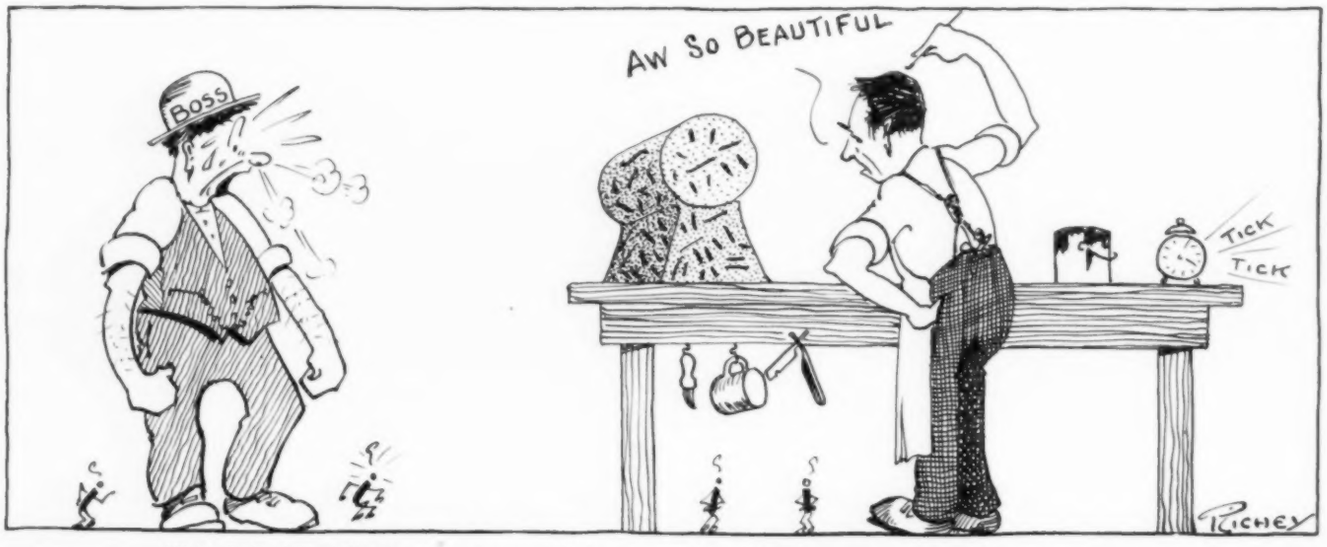
"In former days, and in some instances down to the present, the foundryman covers the risers. The gesture is useless but harmless where no internal commotion occurs in the mold. Where the metal is violently agitated, the cover may conceal the evidence for the time being, but serves as a very poor alibi when the casting is inspected.

"The pipes cause trouble where they are not properly anchored. To a person who is not familiar with the vagaries, the manner in which a long, straight pipe will twist like a snake is beyond belief. In the resulting casting one section of the pipe will show up at one or more places on the cope side of the casting, while another section or sections will cut through at the bottom. This twisting and writhing is caused by expansion during the period the molten metal is covering the pipe, first the bottom surface, then the center and finally the top. This refers more particularly of course to pipes occupying a horizontal position in the mold. Obviously the finished casting cannot function properly where the pipe does not lie as intended in the center. Obviously also the casting will not shrink or contract normally where the pipe, in this instance an interior chill, shifts position and for certain distances lies close to either the top or bottom face of the casting.

"Several methods are available for anchoring the pipes in place. Chaplets must be designed to prevent the pipes from rising or falling, but must allow for longitudinal expansion. In certain instances stem chaplets may be employed, but usually they are unreliable. Bars in the cope may prevent the proper nicety of adjustment, but the principal objection is that the movement of the pipe loosens the contact between pipe and chaplet. In the language of the shop the pipe gets away. Suitable hard bearing points are rammed in the face of the cope and drag against which the flat face of the chaplet rests. This applies to green sand or skin dried molds. The face of a dry sand mold usually requires no reinforcement. Chaplets remain in the casting unless the surface has to be machined. In that case it may be necessary to remove the chaplets and plug the holes.

"Fairly hot metal should be poured into the casting to prevent cold shuts and missruns. Cogni-

(*Concluded on page* 130)



Wild Bull-o'-The-Woods in a few well chosen words politely requests artist's resignation

Activities of FOUNDRY GROUPS

N. Ill.-S. Wis.

OPENING meeting of the current season for the Northern Illinois-Southern Wisconsin Chapter was held Sept. 9, at Hotel Faust, Rockford, Ill., with 44 members and guests present. George K. Minert, Gunite Foundries Corp., Rockford, and chairman of the chapter presided.

A. S. Nichols, sales manager, Illinois Clay Products Co., Joliet, Ill., talked on the history and development of the Goose Lake deposits of fire clay and present day methods of processing the clay. The entire lecture was illustrated by movies. Later in the evening he gave a short description of the equipment and methods used in a laboratory controlled test on the properties of five different bonding agents used in synthetic molding sands, which he also illustrated with movies showing the foundry operations connected with the test. Fred L. Overstreet, Illinois Clay company, who designed the casting used in the synthetic molding sand test, gave a short lecture on the development of the pattern to give optimum conditions for the appearance of any or all defects commonly ascribed to molding sand. He also gave a summary of the defects observed and showed slides of the castings illustrating the defects. Fred Hintze, of the same company, supervised the test and reported on the characteristics of the sands bonded with the various clays. The outstanding observation was the leveling effect of use. Sands with widely divergent characteristics became almost identical after repeated use.

John T. Clausen was appointed chairman of the membership committee and Herbert Klopf was appointed chairman of the program committee. Action was taken on an invitation from the local chapter of the American Society for Metals to join with them in sponsoring a speaker of mutual interest. The decision was left to the board of directors which met and voted to accept for the March meeting.

Next meeting of the chapter will be held Oct. 14, at Hotel Hilton, Beloit, Wis. Ralph C. Kresge, personnel director, Link-Belt Co., Chicago, will discusss, "The Foundry Foreman's Responsibility in Making Personnel Work Effective."—*J. R. Cochran, technical secretary.*

Ontario

THE 1941-42 season for the Ontario Chapter opened up in grand style on Aug. 18 when approximately 120 foundrymen turned out for the third annual picnic at the estate of Rolph Barnes, W. R. Barnes Co. Ltd. Hamilton, at Watertown. Picnic committee composed of Rolph Barnes, chairman; C. C. MacDonald, Frederic B. Stevens of Canada Ltd.; Robert Robertson, International Harvester Co. of Canada Ltd.; Russell Woods, George F. Pettinos Co. of Canada Ltd., Hamilton, and L. B. Morris, Gurney Foundry Co. Ltd. did an excellent job lining up the program and seeing that the events went off according to plan. The picnic followed the general pattern of other years with the afternoon devoted to golf,

A few candid shots taken at the recently held golf outing of the Detroit Chapter. Photos courtesy F. A. Jensen, National Engineering Co., Detroit

shooting, horseshoe pitching and darts. A picnic supper, distribution of prizes and a huge bonfire constituted the evening portion of the program.

Prize winners were as follow: Horseshoes—(1) W. R. Barnes, W. Handzuk; (2) R. Sweet, D. Burns. Darts—(1) D. Muir, (2) H. Turner, (3) J. Wilkinson. Golf—low gross (1) W. Nobbs, (2) R. Banks; low net (1) M. McCaw, (2) G. Memory. Shooting—(1) B. Cioruck, (2) W. Barton, (3) R. Stewart, (4) J. Wells. Members who donated prizes or contributed to the purchase of prizes included Joseph Sully, Sully Brass Foundry Ltd.; T. Clough, Dominion Wheel & Foundries Ltd.; J. Wilkinson, Wilkinson Foundry Facing & Supply Co.; J. Dalby, Canada Metal Co.; D. J. Macdonald, Standard Sanitary & Dominion Radiator Ltd.; S. R. Francis, Metal & Alloys Ltd. C. C. MacDonald; Jack King, W rner G. Smith Ltd.; E. H. McInnis, E. F. Houghton & Co. of Canada Ltd.; A. G. Hawthorne, Canadian Foundry Supplies & Equipment Co. Ltd.; L. B. Morris; Rolph Barnes; Russell Woods; N. B. Clarke, Steel Co. of Canada, Hamilton, and Gordon Memory, North American Refractories Ltd., Hamilton.—*G. L. White, secretary.*

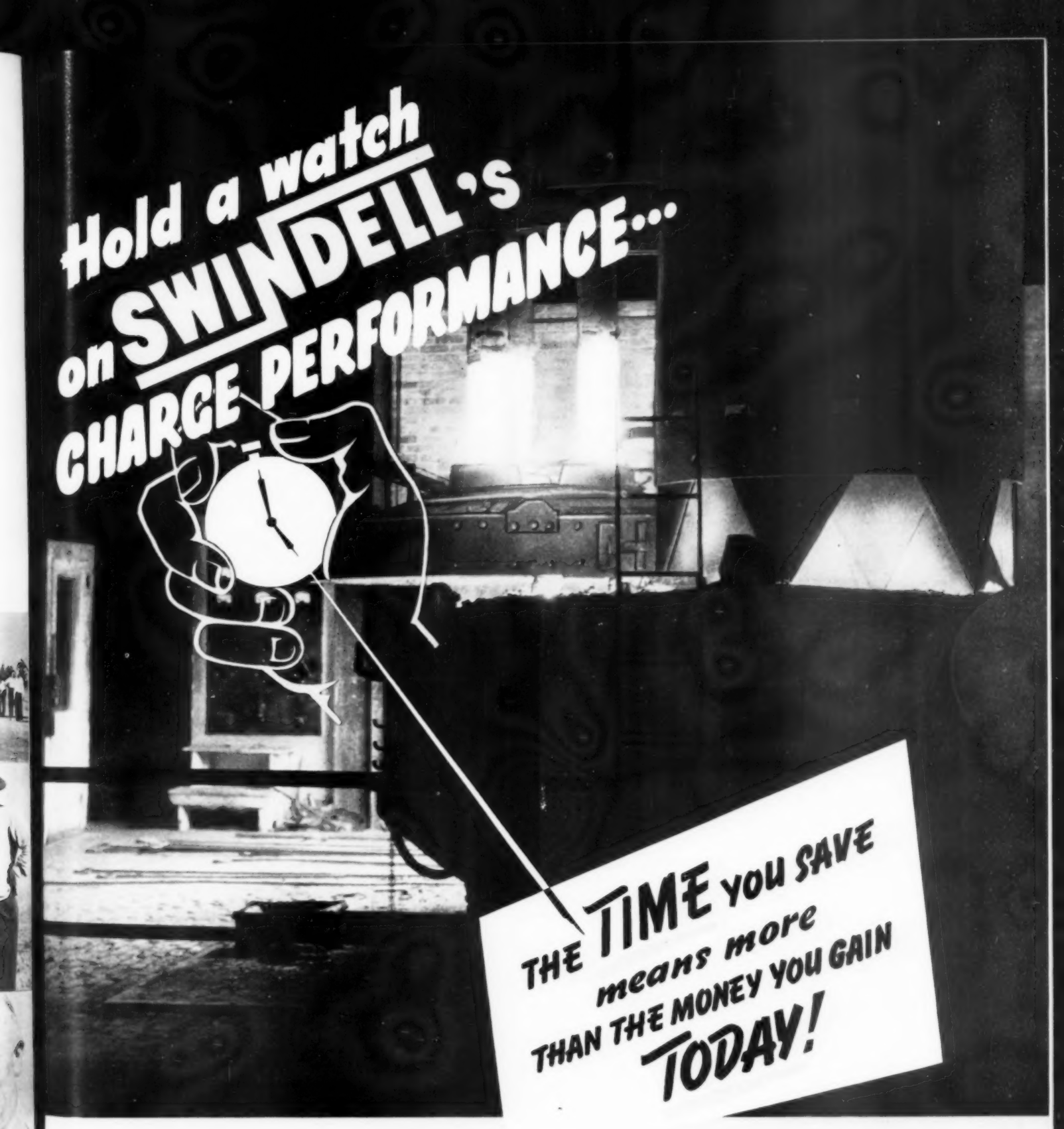
S. California

MORE than 325 members and guests attended the fourth annual stag picnic held by the Southern California Chapter at Lakewood Country club on Aug. 2. Program started at 10 o'clock with 40 entered in the golf bogey tournament which ended in W. W. Farrar, Farrar Industries winning first prize. Second prize was wan by Mr. Waterbury, Alhambra Foundry. During the afternoon a baseball game was held between the foundry supply vendors and the foundrymen and considerable uncertainty which might be blamed on Bob Gregg, the official scorekeeper, developed as to the final score. However, it appears that in the long run the foundrymen were ahead of the vendors. During the game two boys on opposite teams had a little argument so two sets of boxing gloves were procured, and the spectators enjoyed a real 4-round bout.

Horseshoe pitching was one of the main events as were races of all kinds. However, one of the main attractions of the afternoon was Pete Valentine and his accordian group from San Francisco who entertained the crowd. At 6:30 p.m. a buffet dinner was served and at

(*Continued on page* 98)

A large crowd attended the fourth annual stag picnic held by the Southern California Chapter at Lakewood Country club on Aug. 2. Photos Courtesy W. D. Bailey Jr., Westlectric Casting Co., Los Angeles



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(*Concluded from page* 96)

8:30 p.m. a 3-hour stag show was staged. Dick Hughes, chairman of entertainment and his committee deserve considerable credit for the way in which the affair was handled. Colored film of the 8 millimeter size was taken at the picnic, and turned out well. Any other chapters interested in seeing how Southern California has a good time may borrow the film for showing. —*W. D. Bailey Jr., secretary.*

Cincinnati

CINCINNATI Chapter opened its 1941-42 season on Sept. 9 at Shuller's restaurant with an attendance of 42 at dinner, and 55 at the meeting. H. F. McFarlin, past chairman of the chapter introduced the new chairman William Ball Jr., Edna Brass Mfg. Co. who then presided throughout the meeting. Main speaker of the evening was Raymond C. Suran, special agent in charge, Federal Bureau of Investigation, Cincinnati, whose topic was "The F.B.I. in Co-operation with National Defense". He gave an extremely interesting talk covering the work of the F.B.I. in counteracting espionage, sabotage, and fifth columnist activities.—*Henry M. Wood, secretary.*

New England

THE New England Foundrymen's Association opened its current season with an exceptionally well attended meeting at the Engineers' Club Boston, Sept. 10. More than 80 members and guests were present.

Following dinner, Charles O. Butler, president of the association introduced Edward V. Hickey, district manager, Defense Contract Service, Office of Production Management, who told in a most interesting manner how the service came about and what it is attempting to accomplish. He stated that the present war is largely a question of who can produce and deliver first the largest quantity of certain materials used in fighting.

In order to carry out such a procedure, every man and every company must do all possible and at once. Some months ago only 56 companies in the country were producing a large percentage of defense contracts. Naturally this had to be broadened, and to facilitate the distribution of government contracts, a code or method of procedure in the form of commandments, approved by the President, was established, essential points of which Mr. Hickey outlined and explained.

Regulation No. 1 says in general that every bid of more than $50,000 must be open to everyone; No. 2 states that 15 days must elapse between the date the bid is given out and closing date of same; No. 3 deals with the breakdown of large contracts so that bids can be made on a part of it as well as on the whole, also the order does not have to go entirely to the lowest bidder; No. 4 requires the exhibition of components so that small concerns can see just what parts are suitable for their manufacture; No. 5 says orders will be given where possible to regions or districts which are at that time handling less than their fair proportion of government orders; No. 6, early deliveries will count, this benefits companies which at that time have few orders; No. 7, every contract of $50,000 or more must be accompanied by a statement of the percentage of the order which will be farmed out by the prime contractor; No. 8 enables contractors to negotiate with the procurement officer regarding his bid up to 15 per cent above the going price. Mr. Hickey felt that these regulations would help the small concern as well as helping the government to obtain quicker deliveries and to distribute the defense orders so that all would share in the defense work.

At the conclusion of Mr. Hickey's address, President Butler called upon C. E. Andrews, Whitehead Bros. Co., Providence, R. I., who introduced the company's sound and color motion picture, "Sand." The picture was excellent and Mr. Andrew's well chosen remarks added to its enjoyment.

William E. Stanwood of OPM, who accompanied Mr. Hickey, was introduced next, and after he had made a few supplementary remarks, the meeting was turned over to him for general discussion.—*M. A. Hosmer*

St. Louis

FIRST meeting of the 1941-42 season for the St. Louis District Chapter was opened by Vice Chairman C. B. Shanley presiding in the absence of Carl Morken, chairman, with 115 members present. At the outset, a telegram was read from C. E. Westover, vice president of the American Foundrymen's Association, extending best wishes for a successful year. In an effort to expedite movement of the meeting, there were no committee reports, but the secretary was instructed to read a list indicating personnel of the standing committees for the current year.

C. R. Culling, president, Carondelet Foundry Co., and a national director of the A.F.A., gave an interesting coffee talk on the general subject of the Office of Production Management and priorities on pig iron and scrap which was very favorably received. At 8 o'clock the meeting was recessed in order to listen to a radio address by President Roosevelt.

At the conclusion of the President's talk, Mr. Shanley presented Earl E. Woodliff, Harry W. Dietert Co., Detroit, who discussed "Core Practice and Testing." Mr. Woodliff's talk indicated modern methods of core making, core testing with incidental information on sand testing.—*J. W. Kelin, secretary-treasurer.*

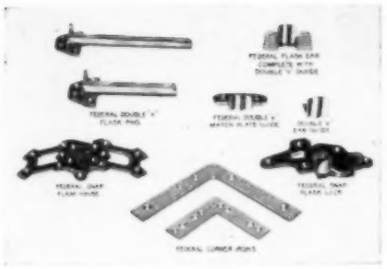
N.E. Ohio

ATTENDANCE of approximately 130 members and guests at the opening meeting of the Northeastern Ohio Chapter on Sept. 11 presaged a good 1941-42 season. Frank Dost, Sterling Foundry Co., Wellington, O., and president of the chapter presided. He called on Jack Lathrop, secretary, who introduced Francis D. Bowman, advertising manager, Carborundum Co., Niagara Falls, N. Y., who gave a brief, interesting talk on manufactured abrasives, and their wide application in modern industry.

He pointed out that natural abrasives such as emery, corundum, garnet and sandstone vary considerably in uniformity and physical properties, but manufactured abrasives are made under controlled conditions which assure uniform dependable products day in and day out. During a period of about 50 years production has risen from a few ounces a day to millions of pounds a month, and manufactured abrasives are available in grain form as well as finished products such as grinding wheels, rubbing bricks, honing stones, etc. Applications range from coarse rough work such as snagging castings to precision grinding requiring accuracy in millionths of an inch.

After Mr. Bowman's talk, a sound motion picture on the same subject was shown through courtesy of the Carborundum Co. At the finish of the film which occurred just before 9 o'clock, the assembled group listened to the momentous speech by President Roosevelt in which he discussed his orders to the Army and Navy relative to keeping open the Atlantic sea-lanes. Next meeting of the chapter will be held Oct. 9.—*Edwin Bremer, publicity chairman.*

Foxboro Co., Foxboro, Mass., has moved its Cincinnati office to a new location, 607 American building, Walnut street and Central parkway.



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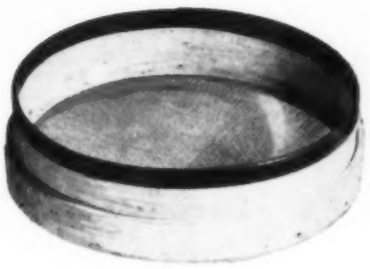
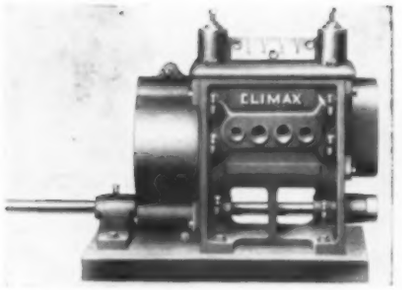
A complete line. They must be good—we've made and sold them for a quarter-century.



FEDERAL "RED TOP" RIDDLES

Extra heavy wire—Northern elm rims. Strong enough for a man to stand on.



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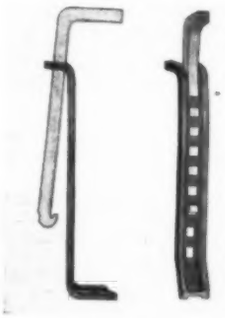

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ADVERTISING PAGES REMOVED

Birmingham Begins Apprentice Work

Recently appointed apprentice training committee of the Birmingham Chapter under the direction of T. H. Benners Jr., T. H. Benners & Co. has arranged to hold 13 meetings during the coming season at the rate of two a month on the second and fourth Fridays with the exception of December when only one meeting will be held. First meeting was held Oct. 1 at which James Bowers, American Cast Iron Pipe Co. spoke briefly. Following his talk a motion picture depicting the construction of welded ships at the Ingalls Shipbuilding Corp. was shown. A lecture describing the various operations accompanied the showing. Next meeting will be held Oct. 24.

Members of the committee in addition of Chairman Benners include: Howard Nelson, Hill & Griffith Co., vice chairman; W. J. Meriwether Jr., American Cast Iron Pipe Co.; J. M. Franklin, Central Foundry Co., Holt, Ala.; William Byrd, Alabama Pipe Co., Gadsden, Ala.; R. L. Ogden, Stockham Pipe Fittings Co.; T. S. Whittet, National Cast Iron Pipe Co.; W. Lee Roueche Sr., McWane Cast Iron Pipe Co.; Gordon Jones, U. S. Cast Iron Pipe & Foundry Co., and W. E. Curren, Republic Steel Corp.

Purdue Conference Program Completed

Joint regional foundry conference to be held at Purdue University, Lafayette, Ind., under the sponsorship of the Central Indiana, Michiana and Chicago Chapters of the A.F.A., and the university on Oct. 17 and 18 will have much of interest according to the recently completed program. Simultaneous sessions on gray cast iron, malleable cast iron, steel and nonferrous subjects will be held both days. A joint chapter dinner will be held Friday evening, Oct. 17 at which E. L. Shaner, president, Penton Publishing Co., Cleveland, will discuss "Material Shortages—Present and Future." A student meeting also will be held at which W. W. Rose, executive vice president, Gray Iron Founders' Society, Cleveland, will speak on "Properties and Uses of Casting." The final program as arranged follows:

Friday, Oct 17

9:00 a.m.—Registration.

10:00 a.m.—Gray Cast Iron.
Technical Chairman: Arthur S. Klopf, vice president, Hansell-Elcock Co., Chicago.
Subject: "Substitutions in Raw Materials for Melting Because of Shortages," by M. J. Gregory, factory manager, Foundry division, Caterpillar Tractor Co., Peoria, Ill.

10:00 a.m.—Malleable Cast Iron.
Technical Chairman: L. H. Rudesill, metallurgist, Griffin Wheel Co., Chicago.
Subject: "Substitutions and Shifts in Melting Materials Because of Shortages," by P. A. Paulson, metallurgist, Gunite Foundries Corp., Rockford, Ill.

10:00 a.m.—Steel.
Technical Chairman—V. A. Crosby, metallurgical engineer, Climax Molybdenum Co., Detroit.
Subject: "Present Situation in Alloys," by D. B. Reeder, metallurgist, Electro Metallurgical Co., Chicago.

10:00 a.m.—Nonferrous.
Technical Chairman: Clifford McKelvey, superintendent, Brass Foundry, Chicago Hardware Foundry Co., North Chicago, Ill.
Subject: "Melting of Nonferrous Metals To Meet Physical Properties and Specifications," by W. B. George, metallurgist and foundry engineer, R. Lavin & Sons, Chicago.

2:00 p.m.—Gray Cast Iron.
Technical Chairman: R. F. Hine, foundry metallurgist, Studebaker Corp., South Bend, Ind.
Subject: "Effect on Melting Practice Due to Substitutions of Materials Because of Shortages," by Dr. James T. MacKenzie, chief metallurgist, American Cast Iron Pipe Co., Birmingham, Ala.

2:00 p.m.—Malleable Cast Iron.
Technical Chairman: J. H. Lansing, shop practice engineer, Malleable Founders' Society, Cleveland.
Subject: "Replacement of Nonferrous and Forged Steel Parts with Pearlitic Malleable Iron," by Carl F. Joseph, metallurgist, Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich.

2:00 p.m.—Steel.
Technical Chairman: H. A. Forsberg, general superintendent, Continental Roll & Steel Foundry Co., East Chicago, Ind.
Subject: "Controlled Directional Solidification," by F. A. Melmoth, vice president, Detroit Steel Casting Co., Detroit.

2:00 p.m.—Nonferrous.
Technical Chairman: Robert Langsenkamp, sales manager, Langsenkamp-Wheeler Brass Works Inc., Indianapolis.
Subject: "Core Practices and Molding Sands for Nonferrous Castings," by H. W. Dietert, president, Harry W. Dietert Co., Detroit.

7:00 p.m.—Joint Chapter Dinner.
Subject: "Materials Shortages—Present and Future." Speaker: E. L. Shaner, president, The Penton Publishing Co., Cleveland. Student entertainment.

Saturday, Oct. 18

9:30 a. m.—Gray Cast Iron.
Technical Chairman: Martin Lefler, foundry manager, Western Foundry Co., Chicago.
Subject: "Modern Methods of Gating and Risering," by Elmer J. Carmody, foundry engineer, Charles C. Kawin Co., Chicago.

9:30 a.m.—Malleable Cast Iron.
Technical Chairman: G. B. Stantial, foundry superintendent, Illinois Malleable Iron Co., Chicago.
Subject: "Gating and Molding Practice," by C. C. Lawson, superintendent, Wagner Malleable Iron Co., Decatur, Ill.

9:30 a.m.—Steel.
Technical Chairman: S. E. McGinty, metallurgist, Burnside Steel Foundry Co., Chicago.
Subject: "Electric Furnace Melting and Construction," by B. J. Aamodt, foundry superintendent, National Malleable & Steel Castings Co., Chicago, and W. Harvey Payne, president and general manager, Hydro-Arc Furnace Corp., Chicago.

9:30 a.m.—Nonferrous.
Technical Chairman: G. E. Stoll, metallurgist, Bendix Products Division, Bendix Aviation Corp., South Bend, Ind.
Subject: "Aluminum Castings," by F. E. Carl, assistant foundry superintendent, Delco-Remy Division, General Motors Corp., Anderson, Ind. "Magnesium Castings," by M. E. Brooks, metallurgist, Dow Chemical Co., Midland, Mich.

1:00 p.m.—Gray Cast Iron.
Technical Chairman: R. L. McIlvaine, foundry engineer, National Engineering Co., Chicago.
Subject: "Factors Affecting Surface Finish of Castings," by W. G. Reichert, general foundry metallurgist, American Brake Shoe & Foundry Co., Mahwah, N. J.

1:00 p.m.—Malleable Cast Iron.
Technical Chairman: E. C. Bumke, superintendent, Malleable division, Oliver Farm Equipment Co., South Bend, Ind.
Subject: "Factors Affecting Surface Finishing and Methods of Cleaning," by James H. Lansing, shop practice engineer, Malleable Founders' Society, Cleveland.

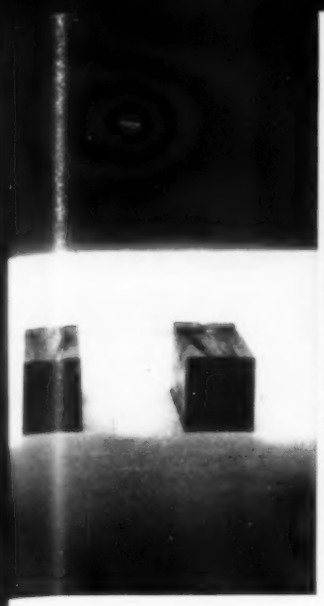
1:00 p.m.—Steel.
Technical Chairman: H. K. Briggs, sales metallurgist, Miller & Co., Chicago.
Subject: "Triplex Melting of Steel," by A. W. Gregg, foundry engineer, Foundry Equipment Division, Whiting Corp., Harvey, Ill.

1:00 p.m.—Nonferrous.
Technical Chairman: Robert Langsenkamp, sales manager, Langsenkamp-Wheeler Brass Works Inc., Indianapolis.
Subject: "Gates and Risers for Nonferrous Castings," by W. B. George, metallurgist and foundry engineer, R. Lavin & Sons, Chicago.

Time not established—Student Meeting.
Chairman: C. E. Westover, executive vice president, American Foundrymen's Association, Chicago.
Subject: "Properties and Uses of Castings," by W. W. Rose, executive vice president, Gray Iron Founders' Society, Cleveland.

Hold Symposium on Industrial Health

The Second Annual Meeting held under the auspices of the American Association of Industrial Physicians and Surgeons and the American Conference on Industrial Health will be held at Chicago Towers, Chicago, November 5 and 6. The opening session will be a symposium on the technical problems of industrial health on the basis that health service in industry involves two principles, namely the adjustment of the working environment to the employee and the adjustment of the employee to the working environment, including also the human environment. The afternoon session will be a symposium on the economics of industrial health. The morning session of the second day will be given over to a symposium of the social implications of industrial health. The sessions will close with a schedule of plant medical department inspection through the co-operation of Chicago industries.



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3 MAKE SURE YOUR EQUIPMENT IS IN GOOD CONDITION

The right refractory, correctly installed, will still not give the results you can rightfully expect if your furnace equipment is not in good condition. All burners should be properly adjusted, and mechanical parts in proper working order. The frequent inspections and careful servicing necessary to maintain this condition will be amply repaid in higher efficiencies and lower costs.

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REFRACTORY DIVISION, PERTH AMBOY, N. J.

PRIORITY ASSISTANCE GRANTED FOR REPAIR WORK IN FOUNDRIES

A NEW and streamlined plan to grant priority assistance for repair work in certain essential industries was issued Sept. 9 by Donald M. Nelson, Director of Priorities. It represents an effort to keep American Defense industries running at full speed, and to prevent any break in the increasing tempo of defense production. According to an interpretation of OPM, foundries are included under the classification (xii) Metallurgy—plants engaged in the production of metals and alloys.

The new plan takes the place of the Maintenance and Repair Order which was announced Aug. 8, but which was never actually issued because of administrative difficulties in handling the paper work it would have involved.

The new plan, which becomes available immediately, is set up along simple lines. It provides machinery under which priority status for repair work in twenty industrial classifications can be obtained, so that firms and agencies in these classifications may obtain repair parts promptly.

The revised scheme permits qualified producers or suppliers to apply a preference rating of A-10 to deliveries of required repair parts by endorsing a special statement on purchase orders, certifying that the material being ordered is for repair work under the terms of the order, P-22.

The order can be used also to get deliveries for "emergency inventory."

Repairs are defined in the order as repairs needed because of an actual or imminent breakdown. Emergency inventory is defined in the order as the minimum inventory of material required to provide for repairs to meet an actual or imminent breakdown.

The present order is designed primarily to protect industry against sudden breakdowns and is regarded as an interim measure. The entire inventory problem is to be studied further with a view to providing broader priority assistance. It is felt, however, that the present plan will keep the essential industries covered running on their normal basis and will prevent serious interruption to defense production by giving producers a simple method for obtaining vital repair parts.

The order itself, which follows should be read carefully by all those who are to operate under its terms. The industries covered are listed specifically in the order. Other classifications may be added from time to time, and special orders may be worked out to meet problems in certain industries.

Title 32—National Defense
Chapter IX—Office of Production Management
Subchapter B — Priorities Division
Part 958—Repairs
Preference Rating Order No. P-22

958.1 Preference Rating Order. For the purpose of facilitating the acquisition of material for the Repair of the property or equipment of certain industries and services hereinafter specified, a preference rating is hereby assigned to deliveries of Material for such purpose upon the following terms:

(a) DEFINITIONS.

(1) "Producer" means any individual, partnership, association, corporation, governmental unit, or other organization engaged in one or more of the following industries and services, and such other industries and services as may be added from time to time by supplement to this Order:

(i) The following federal, state, county, and municipal services: Fire and police services; highway maintenance.

(ii) Carriers:

(a) Urban, suburban, interurban, and intercity common, contract, and private carriers of passengers or freight by electric railway, electric coach, motor truck, or bus, including terminals.

(b) Railroads, including terminals.

(c) Shipping — Commercial carriers of freight and passengers by ocean, lake, river, or canal, including terminals.

(iii) Chemicals—Plants engaged in producing chemicals by chemical processing of raw materials.

(iv) Coke converting.

(v) Educational institutions (including vocational training).

(vi) Explosives—plants engaged in manufacturing explosives.

(vii) Farm machinery and equipment — plants engaged in manufacturing farm machinery and equipment.

(viii) Food processing or storing—plants engaged in any of the following: milling, refining, preserving, refrigerating, wholesaling or storing of food for human consumption or livestock feed.

(ix) Highway maintenance and equipment—plants engaged in the production of equipment used in highway maintenance.

(x) Hospitals, clinics and sanatoriums.

(xi) Lumber—plants engaged in the production of lumber (including planing, drying, storing, and treating of lumber), cooperage, plywood, and millwork.

(xii) Metallurgy—plants engaged in the production of metals and alloys.

(xiii) Mines and quarries (including ore dressing or processing plants and smelting facilities).

(xiv) Newspapers—plants engaged in the publication of newspapers.

(xv) Petroleum production, refining and transportation—plants and equipment used in petroleum production, refining and transportation.

(xvi) Radio—Commercial broadcasting and communication (not including home receiving sets).

(xvii) Research laboratories industrial and academic.

(xviii) Rubber and rubber products—plants engaged in the production of rubber and rubber products including reclaimed and synthetic rubber.

(xix) Shipyards and Ship Repair Yards engaged in building and repairing ships (excluding yards devoted principally to pleasure craft).

(xx) Telephone and telegraph communication.

(2) "Material" means any commodity, equipment, accessories, parts, assemblies, or products of any kind.

(3) "Repairs" means only repairs needed because of an actual or imminent breakdown, from whatever cause, of a Producer's property or equipment.

(4) "Emergency Inventory" means minimum inventory of Material required to provide for Repairs to meet an actual or imminent breakdown, from whatever cause, of a Producer's property or equipment.

(5) "Supplier" means any person with whom a purchase order or

(*Concluded on page* 110)

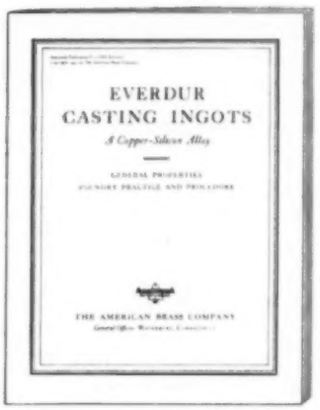
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Because time is so important . . .

No time today for trial and error methods in industry. Experience counts more than ever before. At Waterbury, Connecticut, in the offices of our engineers and technicians, there is a vast store of metallurgical experience which you may feel free to call upon —especially regarding any problems which may arise in connection with our metals.

And in particular . . .

To your foundrymen, here is a book of particular interest. It's called "Everdur Casting Ingots." It explains thoroughly the practice to be followed, the properties of the metal, handling methods, in short, just the kind of information you need to save time in specifying and producing. A copy will be mailed you as soon as your request is received.



Everdur copper-silicon alloy for casting purposes is a high-strength material, relatively inexpensive, but possessing many of the desirable properties usually associated with higher-priced metals.

Everdur offers outstanding resistance to a large number of normally corrosive solutions and atmospheres. Obviously, it is not equally resistant to all. Information regarding the corrosion resistance of Everdur under specific conditions may be obtained from the Technical Department of The American Brass Company.

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Everdur {COPPER-SILICON} *Casting Alloy*

THE AMERICAN BRASS COMPANY • General Offices: Waterbury, Connecticut

Subsidiary of Anaconda Copper Mining Company. In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

(*Concluded from page* 108)

contract has been placed by a Producer or any Supplier for

(i) Material to be used for Repairs;

(ii) Material required for a Producer's Emergency Inventory;

(iii) Material to be physically incorporated in other Material which is to be used for Repairs or which is required for a Producer's Emergency Inventory.

(b) ASSIGNMENT OF PREFERENCE RATING. Subject to the terms of this Order, Preference Rating A-10 is hereby assigned

(1) to deliveries to a Producer of Material required by him for Repairs or for his Emergency Inventory;

(2) to deliveries to a Supplier of Material which is, in turn, to be delivered to a Producer for Repairs or for his Emergency Inventory or to be physically incorporated in Material to be so delivered.

(c) PERSONS ENTITLED TO APPLY PREFERENCE RATING. The preference rating hereby assigned may be applied by

(1) a Producer;

(2) a Supplier, provided that he requires the Material so purchased in order to make deliveries duly rated pursuant to paragraph (b).

(d) APPLICATION OF PREFERENCE RATING.

(1) A Producer in order to apply the preference rating to a delivery of material to him must endorse the following statement on the original and all copies of the purchase order or contract for such Material signed by a responsible official duly designated for such purpose by such Producer.

"Purchase Order for Repair or Emergency Inventory-Preference Rating A-10 under Preference Rating Order P-22."

Such endorsement shall constitute a certification of the Office of Production Management that such Material is required for the purposes stated therein. Any such purchase order or contract shall be restricted to material the delivery of which is rated in accordance herewith.

(2) A Supplier in order to apply the preference rating to a delivery of Material to him must endorse the following statement on the original and all copies of the purchase order or contract for such Material signed by a responsible official duly designated for such purpose by such Supplier:

"Purchase Order for Material required to fill a duly rated order for Repair or Emergency Inventory. This purchase order bears Preference Rating A-10 under Preference Rating Order P-22."

Such endorsement shall constitute a certification to the Office of Production Management that such Material is required to fill an order placed by a Producer or Supplier duly rated in accordance herewith. Any such Supplier's purchase order or contract shall be restricted to Material the delivery of which is rated in accordance herewith.

(3) A producer or Supplier placing any such rated purchase orders or contracts and the Supplier selling the Material covered thereby, must each retain endorsed copies of such purchase orders or contracts segregated from all other purchase orders or contracts for a period of two years from the date thereof for inspection by authorized representatives of the Office of Production Management.

(e) RESTRICTIONS ON APPLICATION OF RATING. The Preference Rating thereby assigned shall not be applied

(1) by a Producer to obtain Material in excess of his requirements for Repairs or for his Emergency Inventory;

(2) unless the Material to be delivered cannot be obtained when required without such rating;

(3) by a Supplier to obtain Material in excess of the amount necessary to make rated deliveries.

(f) FALSE STATEMENTS AND PENALTIES. Any person who applies the preference rating hereby assigned in wilful violation of the terms and provisions of this Order, or wilfully falsifies records required to be kept or information to be furnished pursuant to this Order, or who obtains a delivery of Material by means of a material and wilful misstatement will be prohibited from further applying said rating. Such person may also be prohibited from obtaining further deliveries of Material under allocation and be deprived of any other priorities assistance. The Director of Priorities may also take any other action deemed appropriate, including the making of a recommendation for prosecution under Section 35A of the Criminal Code (18 U. S. C. 80).

(g) REVOCATON OR MODIFICATION. This Order may be revoked or amended by the Director of Priorities at any time in whole or in part or in its application to any Producer or any Supplier. In the event of revocation, or upon expiration of this Order, deliveries already rated pursuant to this Order shall be completed in accordance with said rating, unless the rating has been specifically revoked. No additional applications of this rating to any other deliveries shall thereafter be made by any Producer or Supplier affected by said revocation or expiration.

(h) EFFECTIVE DATA. This Order shall take effect on the 9th day of September, 1941, and unless sooner revoked shall expire on the 28th day of February, 1942.

(P. D. Reg. 1, Aug. 27, 1941, 6 F.R. 4489; O. P. M. Reg. 3, March 8, 1941, 6 F.R. 1596; E. O. 9629, Jan. 7, 1941, 6 F. R. 191; E. O. 8629, Aug. 28, 1941, 6 F. R. 4483; sec. 2(a), Public No. 671, 76th Congress, Third Session, as amended by Public No. 89, 77th Congress, First Session; Sec. 9, Public No. 783, 76th Congress, Third Session.)

Issues Repair Plan Interpretation

On Sept. 15 Donald M. Nelson, Director of Priorities, issued an interpretation of the Repair Plan for essential industries announced on Sept. 9 and presented on the foregoing pages of this issue.

The interpretation applies in the case of an organization which has two or more plants, not all of which fall within the classification of essential industries which may use the Repair Plan.

In such a case, the interpretation says, the special preference rating may be used to get repair materials only in those plants which fall within the classifications set forth in the original order.

The interpretation follows:

TITLE 32 — NATIONAL DEFENSE; CHAPTER IX — OFFICE OF PRODUCTION MANAGEMENT; Subchapter B — PRIORITIES DIVISON; Part 958 — REPAIRS; Interpretation of Preference Rating Order No. P-22.

The following official interpretation is hereby issued by the Director of Priorities with respect to **§ 958.1, Preference Rating Order No. P-22,** dated Sept. 9, 1941.

Where an individual, partnership, association, corporation, governmental unit or other organization operates two or more plants, one or more of which is within any of the classifications listed in paragraph (a) (1) (i-xx) of said §958.1 and the remainder of which are not within such classifications the Order permits the application of the preference rating only to deliveries of material required for repair purposes in those plants within the classifications specified in said paragraph (a) (1) (i-xx) of said Order. The rating may not be applied to obtain repair material for plants not engaged in the specified activities.

Department of Labor and Industry, Commonwealth of Pennsylvania, Harrisburg, Pa., recently has published an 8-page bulletin entitled "Good Housekeeping in a Steel Foundry," by J. E. Turner.

THE IRON-CARBON SYSTEM AND ITS EFFECT ON CASTINGS

By J. W. JUPPENLATZ
Metallurgist
Treadwell Engineering Co., Easton, Pa.

PREVIOUSLY irons *A* to *D* have been indicated on the curves, representing the formulas of effective carbon for cast iron as C plus 0.3 Si. Taking a constant of 2 per cent silicon, the effective carbon is changed to the order of plus 0.6 per cent. Thus:

Iron	C plus (0.3×2 Si)	=	C_e
A	3.50 plus 0.6	=	4.10
B	3.00 plus 0.6	=	3.60
C	2.50 plus 0.6	=	3.10
D	2.00 plus 0.6	=	2.60

To those we will add another iron

X	4.00 plus 0.6	=	4.60

By using the iron carbon diagram and the formulas, we have a better understanding of how carbon and silicon influence the position of the eutectic. Cast irons below the eutectic composition (E) are termed hypoeutectic and those above hypereutectic. Hypereutectic irons are unstable and, therefore, cause erratic results upon casting. Often irons with compositions in the vicinity of the eutectic are in the hypereutectic state when molten. Irons such as the hypereutectic type, such as iron *X*, tend to reject graphite upon normal cooling in the liquid state and this continues through the graphitization range. Kish is the common term applied to this rejected graphite. We often have noted this graphite formation in risers which sometimes cauliflower, as a graphite rich center.

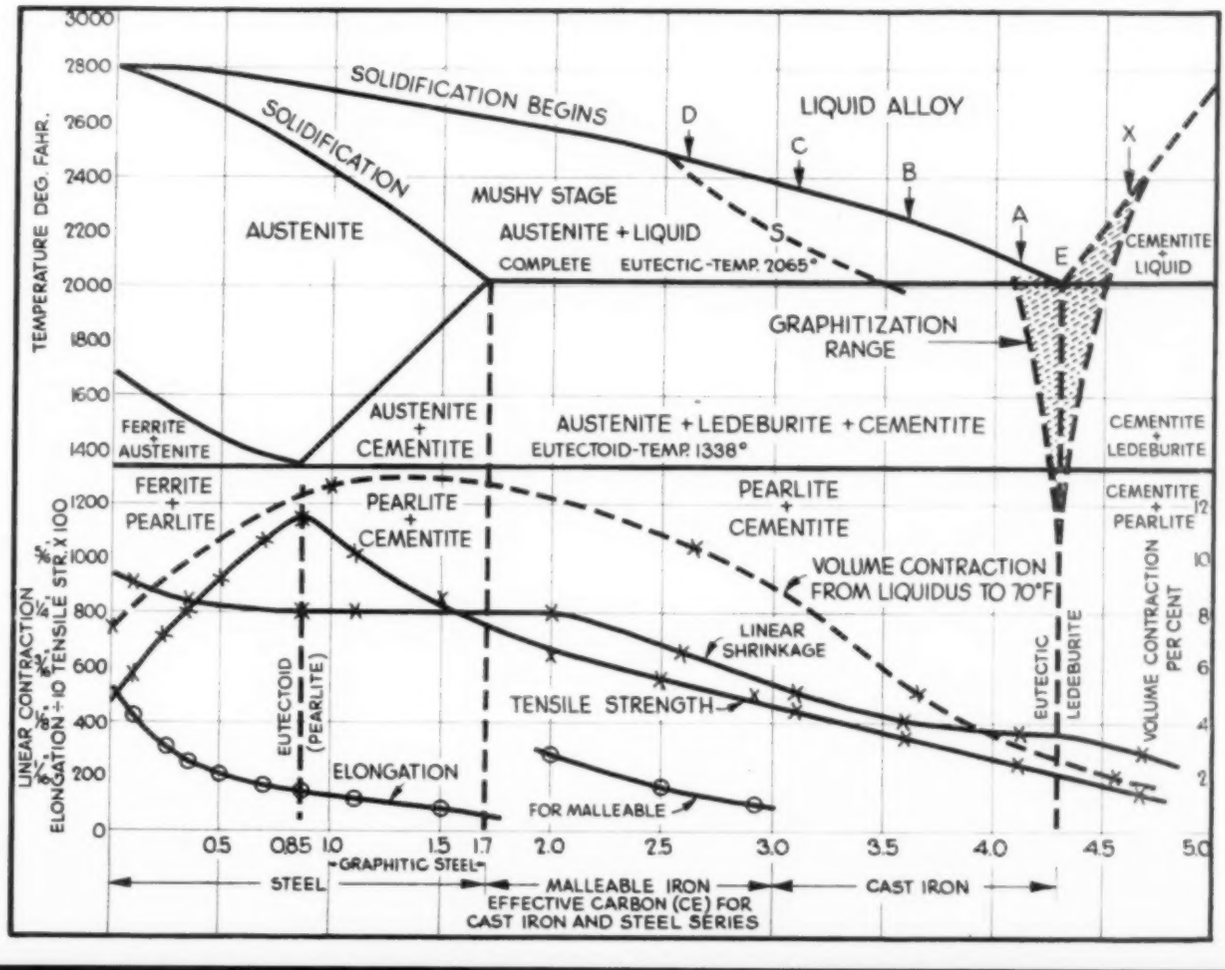
Castings containing kish or graphite pockets in heavy sections often leak under hydrostatic pressure. Many castings appear to be solid under the risers in heavy sections which cooled slowly in the molds, but when heavy machine cuts are taken chunks of graphite rich areas are torn loose. Normal chemical analysis may show only 3.40 per cent carbon, but these kish like areas may analyze over 4.00 per cent carbon, due to segregations.

Hypereutectic irons easily can lead the foundryman into many difficulties as linear shrinkage may take place normally or even be nil. Physical properties may be inconsistent varying as much as 15,000 pounds per square inch in tensile values. Then the castings may be rejected as being unfit on account of leakage, tearing in machining, or soft areas which are graphite rich.

Before leaving the hypereutectic class of iron, it is desired to inject a few thoughts on that class of pig iron. Foundrymen objecting to pig irons containing kish, scruf and shot probably are justified. Some time ago we had a quantity of 3.00 per cent silicon-3.75 per cent carbon pig iron that contained numerous rounded shot on the chill mold surfaces and pretty rough kish "leaf-like" formations on the top. We melted this pig as a part of the charge in the cupola in the normal manner and oddly some of our castings upon machining and fracture had the same appearance, containing shot and the kish like formation resembling the pig that we were using.

We immediately blamed the pig iron as the cause of these casting defects and the pig iron representatives had other thoughts, so we took some of this pig iron and melted it in a Detroit electric furnace without any further additions. When a

Iron-carbon diagram on which has been superimposed the data on tensile strength, elongation, linear contraction and volume contraction of different alloys



temperature of 2900 degrees Fahr. was reached, we tapped into a ladle, skimmed properly and poured test castings. The fractures of these castings were identical in appearance to those of the original pigs, containing shot and kish formations.

As it now is realized, that pig iron was distinctly hypereutectic and if we had taken the kish formation into account on the original analysis, a higher total carbon would have been found. We do know some of these hypereutectic shot passed through the cupola unmelted and would like to know their true melting point, as it was evidently in excess of the melting temperature 2900 degrees Fahr.

Let us leave the molten and mushy phases and consider what takes place upon complete solidification. Here we have carbon in iron in the solid solution form. In other words, we have the carbon in solid iron which may migrate and assume different forms and compounds. The carbon content, temperature and rates of cooling are controlling factors.

Use Original Terms

The author had hoped to shun technical terms but in order to discuss briefly in short form these solid phases, no substitutes are known and the original terms best can be applied.

When an iron of 1.7 per cent carbon cools from the eutectic temperature, cementite precipitates from solid solution of austenite until a temperature of 1333 degrees Fahr. is reached with a carbon content of 0.85 per cent. This is called the cementite solubility curve.

From zero carbon at a temperature of 1670 degrees Fahr. ferrite (iron) separates from the austenite to 0.85 per cent carbon at a temperature of 1333 degrees Fahr. This is called the ferrite solubility curve.

At 0.85 per cent carbon and 1333 degrees Fahr. we find the lowest point of temperature between the ferrite and cementite solubility curves. It is called the eutectoid temperature and composition, being somewhat analogous to the eutectic. The phase above these curves is called austenite.

The eutectoid temperature remains practically constant throughout the carbon range at 1333 degrees Fahr. and the curve may be so extended. Briefly summarizing these phases, we have above the eutectoid temperature:

0 to 0.85 per cent carbon ferrite plus austenite
0.85 to 1.7 per cent carbon austenite plus cementite
1.7 to 4.3 per cent carbon austenite plus ledeburite plus cementite
4.3 plus carbon cementite plus ledeburite

At temperatures below the eutectoid we have still another change of phases from:

0 to 0.85 per cent carbon ferrite plus pearlite
.85 to 1.7 per cent carbon pearlite plus cementite
1.7 to 4.3 per cent carbon cementite plus pearlite
4.3 plus carbon cementite plus pearlite

To complete the applied terms of the curves, the mushy stage in hypoeutectic irons is called austenite plus liquid and hypereutectic irons, cementite (iron-carbon) plus liquid. Applying some of these terms in foundry language: Ferrite is iron which is soft and ductile. Pearlite is a mild iron-carbide which promotes strength and hardness. Cementite is a hard brittle iron-carbide causing cast iron to be white and is unstable, changing into graphite, ferrite and pearlite by slow cooling.

Carbon Content and Tensile Properties

Carbon Per Cent	Tensile Strength Pounds per Square Inch	Elongation Per Cent in 2 inches
0.70	108,000	16
0.50	92,000	20
0.35	80,000	25
0.25	70,000	30
0.10	58,000	42

Let us return to irons *A*, *B*, *C*, *D* and *X* and examine what we might expect in the form of physical characteristics of the final casting, using a 1.2-inch diameter arbitration test bar for physical values, casting and cooling in the molds in a similar manner.

Iron *A* will have a dark gray fracture, quite open and a tensile strength of about 24,000 pounds per square inch. Its structure will consist mainly of ferrite, graphite and a little pearlite. The fracture of iron *B* will be lighter in color, more dense than *A* and have a tensile of about 34,000 pounds per square inch. The amount of pearlite increases, with less ferrite and graphite than iron *A*.

Iron *C* will have a fracture still lighter in color than iron *B* with a possible white or mottled edge with a tensile of 46,000 pounds per square inch. The structure will be nearly all pearlite and graphite. Iron *D* will have a white fracture with variable tensile values. Its structure will consist of cementite with little or no graphite. Iron *X* will have a black-graphite appearing fracture, very open and tensile values may be as low as 15,000 pounds per square inch.

While discussing the physical characteristics of cast iron, the author will attempt to represent graphically the graphitization range which is dependent upon composition and rate of cooling. Graphitization of hypereutectic irons, which are very unstable, seems to begin at the initial freezing point and continues to take place upon slow cooling abundantly at the higher temperatures, decreasing in amount as the temperature is lowered. Little graphitization takes place after reaching a temperature of 1333 degrees Fahr. (eutectoid), but further graphitization may take place down to about 850 degrees Fahr. upon extremely slow cooling.

Cone Shape Curves

Graphitization of hypoeutectic irons probably does not take place until the eutectic temperature is approached, differing from the hypereutectic irons in this respect only. Curves for both classes of iron will be indicated by cone shaped curves, the wider the cone, the greater the amount of graphitization. Also the greater the time at these indicated temperatures, the more completely the cementite (iron-carbon) will be broken down into graphite and ferrite.

Size of the graphite flake and its manner of distribution largely control the physical characteristics of the iron. An iron containing about 3 per cent graphite by weight represents about 10 per cent graphite by volume. Graphite possesses practically no strength. The graphite flakes are imbedded into a matrix of ferrite (iron), pearlite or cementite as the condition may be, which is analogous to carbon steels, except for the presence of graphite.

Those constituents also control physical properties of cast irons and generally are referred to as combined carbon. For example, a cast iron containing about 0.75 per cent carbon in the combined form will have a pearlitic matrix. The composition and cooling rates being such that the cementite or iron-carbide did not completely break down into graphite and ferrite so the resulting carbides assumed the pearlite formation.

If the cementite in cast irons does not break down upon cooling into graphite, pearlite or ferrite, it will retain its form of cementite, as white iron. This condition may be produced by rapid cooling, so little or no graphite can be formed, such as casting against a chill or adjusting the composition so the resulting casting will be white by normal cooling in the molds. White iron is very brittle and hard. Its tensile values may vary as much as 20,000 to 50,000 lbs. per sq. in.

Its shrinkage is greater than gray

(*Concluded on page* 116)

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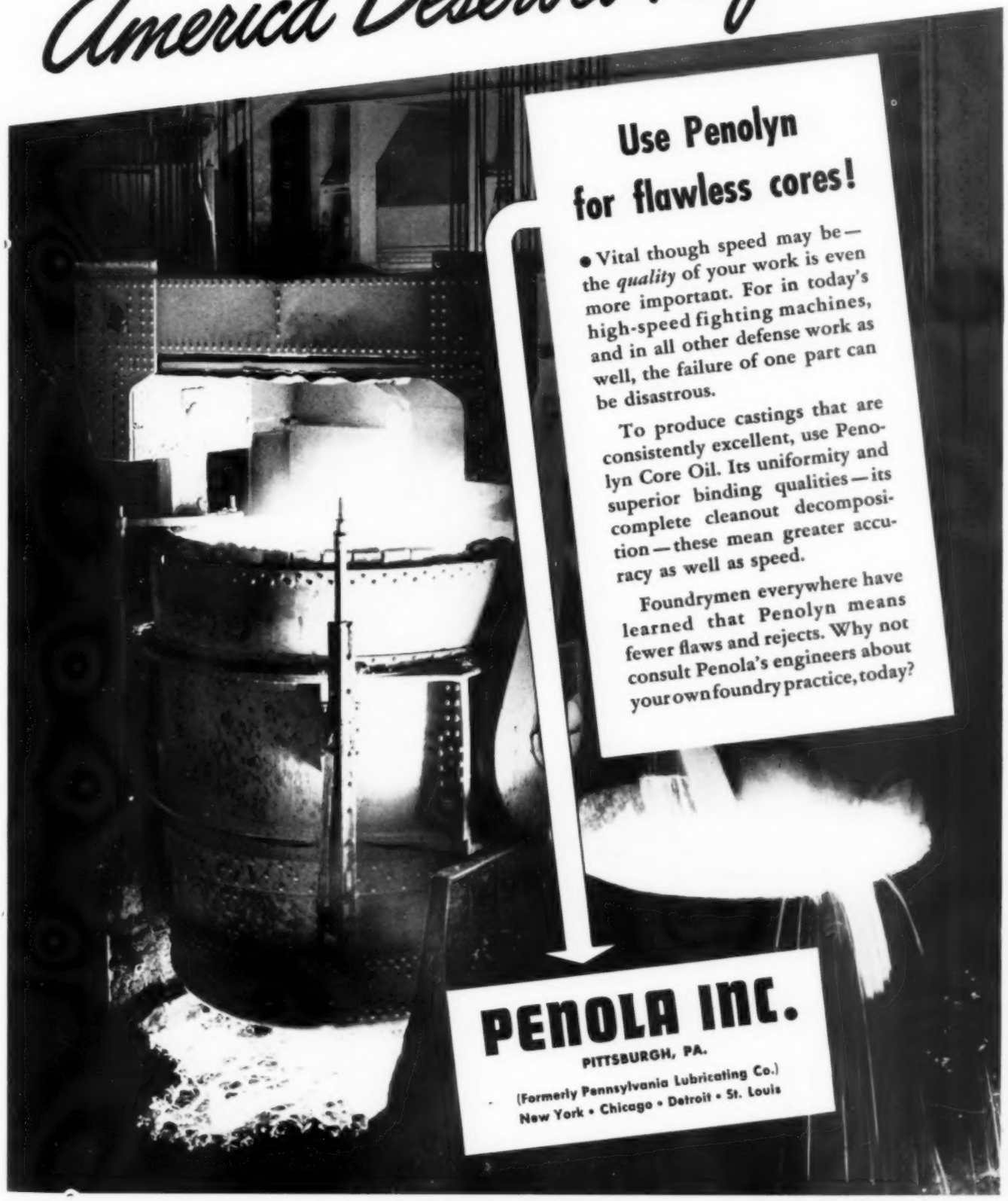

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(*Concluded from page* 114)

iron, internally and linearly. A practical example may be cited in this respect. We used to make large quantities of white iron grinding balls from a match plate pattern. When the gates were broken off a shrink hole appeared and losses ran high. Using the same pattern, we later made those so the castings were gray with sufficient chromium present to effect excellent wearing qualities after quenching for hardness. Shrinkage cavities were not present due to the counteracting effect of graphitization.

The higher the carbon content of white iron, the greater will be its hardness with accompanying loss in tensile and impact values. Also the lower carbon white irons have higher shrinkage properties, both linearly and internally.

Mottle Separates Structures

Chilled irons are combinations of white and gray irons, separated by an inter-mixture of the combination which is called mottled iron. Mottled iron contains cementite free graphite and pearlite. Mottled irons usually do not present any serious foundry problems but chilled irons are the source of innumerable troubles, and are affected by:

1. Composition
   (a) Lower carbon gives greater depth of chill.
2. Pouring temperature
   (a) Lower temperature greater depth of chill.
3. Rate of cooling.
   (a) Section and temperature of chill
   (b) Section of chilled casting.
   (c) Time in contact with chill.

Design of chilled iron castings is of major importance to the foundryman, especially in cylindrical objects such as rollers, sprockets, etc. where casting stresses may build up to proportions which may cause fracture. Depth of chill is very important and should be controlled carefully. Since white iron shrinks about 3/16 to ¼ inch per foot and gray iron about ⅛ inch, it is easily seen why chilled iron castings often crack.

Some foundries, especially those making car-wheels, remove chilled iron castings from the mold while hot and anneal for strain equalization. Proper design, composition, chilling effect and pouring temperatures must be closely controlled to produce chilled iron castings successfully.

Malleable iron is iron low in carbon and silicon. In the as-cast state it is white or cementitic, containing little or no graphite. High carbon irons carry a lower silicon and low carbon irons higher silicon, which reverts back to the thought of effective carbon as in cast irons. Malleable castings are too brittle to have any commercial value in the as-cast state and are annealed at temperatures above the eutectoid temperature for conversion of the cementite, into temper carbon (graphite nodules) and ferrite to promote ductility. Properly annealed malleable will have a tensile strength of about 54,000 pounds per square inch with an elongation of 20 per cent. Lower carbon irons will have higher tensile values. Low carbon irons respond to heat treatment quicker than high carbon iron, resulting in a shortened annealing cycle.

Graphitic steels contain from 1.0 to 1.7 per cent carbon with silicons of 1 to 2 per cent. Personal experience with those compositions is limited. However, Ford Motor Co. has accomplished success with this range of analysis by alloying, closely controlling compositions, and by heat treatments. These alloys are considered non-eutectiferous and graphite formation is of nodular character. Tensile strengths of 85,000 pounds per square inch and 8 per cent elongation are typical of the annealed condition.

Cast steels containing 1.10 per cent carbon with normal silicon of about 0.30 per cent will be practically free from graphite, and the carbon will be in the form of pearlite and cementite. The annealed tensile values are about 100,000 pounds per square inch with 8 per cent elongation. Castings of the eutectoid composition, 0.85 per cent carbon, are considered pearlitic with 115,000 pounds per square inch tensile strength with 12 per cent elongation. These castings are the strongest of the carbon series. As the carbon content decreases typical tensile values are shown in the accompanying Table.

Pearlite Amount Decreases

With lower carbon contents, the amount of pearlite decreases with increasing amounts of ferrite. Ductility increases with lower carbons and tensile values drop. Castings containing about 0.10 per cent carbon cannot be hardened appreciably, even by quenching. They are able to withstand thermal shocks, rapid heat changes and dilations better than higher carbon series. Welding and normal foundry operations may be conducted with little fear of crack formations ever present with increasing carbon contents.

We have taken the opportunity to superimpose on the diagram the curves showing linear shrinkage volume contraction (liquidus to room temperature, per cent) tensile and elongation values with the values of annealed malleable iron. The values are typical average results of normal foundry compositions generally accepted as unalloyed. Alloys such as nickel, chromium, molybdenum, copper, etc. affect these figures considerably.

There is a phase concerning the application of the iron-carbon system to foundry work in a practical way which should receive consideration. We normally refer to an iron or steel with a definite analysis, usually determined from a heat test or test bar. This information is usually only indicative of the actual conditions. The analysis represents chemical conditions of a definite cooling rate of the casting in the form of a test piece, which does not represent larger casting sections that cooled more slowly.

Highest Freezing Point

Iron-carbon alloys upon casting in a mold freeze in a selective manner. The skin will contain the purest and highest freezing point composition. It will contain the least amount of segregating elements such as carbon, manganese, sulphur and phosphorus, as these all lower the melting points of iron. As freezing progresses, the purest constituents continue to freeze out rejecting the lower melting point compositions toward the center until solidification is completed. This phase is called segregation and is an enemy to the foundryman especially in large slowly cooled castings.

In low carbon steels and irons segregation is proportionately less than in higher carbon grades. The author will indicate graphically his conception of segregation of a 3.0 per cent carbon iron which has slowly cooled from casting temperatures. The average composition may be normally considered as *S*. The dotted curve on the diagram shows a skin with a carbon content of 2.5 per cent carbon and a center of 3.5 per cent carbon. It is easily seen that these changes of composition directly affect the resulting constituents upon cooling. Those conditions of segregation are often neglected in the interpretation of foundry problems.

In conclusion, the author wishes to say that the figures and curves of the iron-carbon system as discussed are relative rather than exact. If information is desired regarding definite foundry compositions for research or comparative purposes, individual tests should be conducted. With the development of better working tools, such as temperature measuring and recording devices, methods of determining hot strengths, volume changes, thermal conductivities, etc. research will probably continue to reveal changes of composition and practice that will work in the foundry to produce better castings.

This is the concluding article taken from a paper presented at a meeting of the Reading Foundrymen's association. This first article appeared in the July issue.

THE EDITORS

INTERNATIONALS

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to meet
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Foundries in which
MAXIMUM PRODUCTIONS
are maintained are equipped
with

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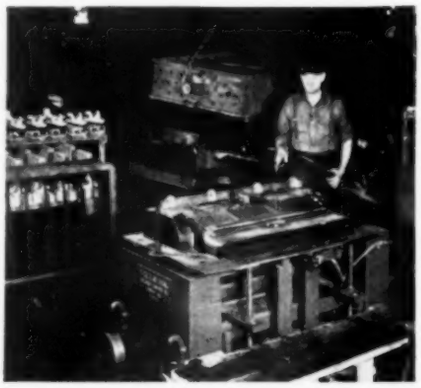
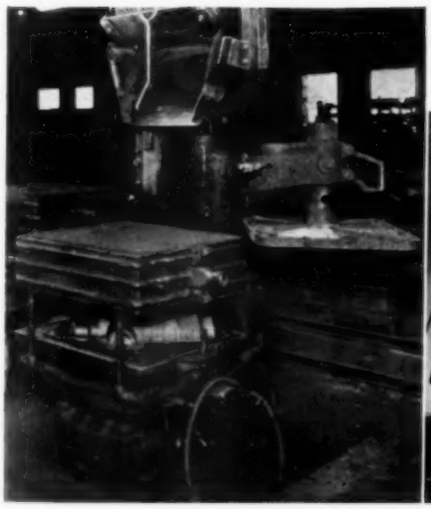
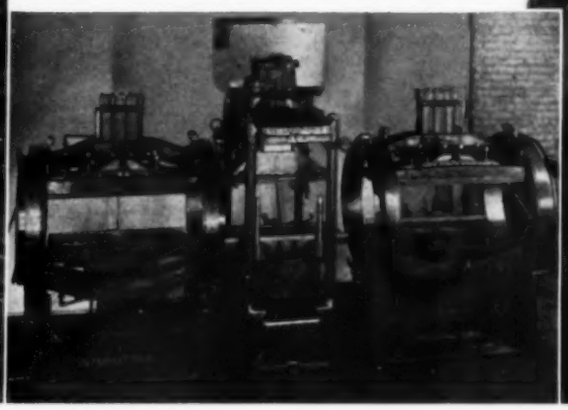


INTERNATIONAL
MOLDING MACHINE CO.
2608 - 2624 W. 16th St., Chicago, Ill.





HANDLING MATERIALS IN IRON AND STEEL FOUNDRY

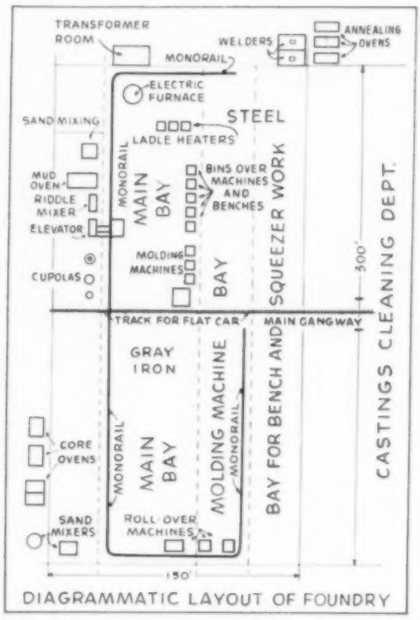
By FRANCIS A. WESTBROOK

MECHANICAL handling of materials has been worked out ingeniously and with efficient economy in the gray iron and steel foundry of the Sullivan Machinery Co., Claremont, N. H., manufacturers of a wide line of air compressors and pneumatically operated devices.

The foundry building approximately 150 x 300 feet is divided by columns into four longitudinal bays and these in turn are divided transversely at the center by a wide gangway and narrow gage industrial railroad as shown in the accompanying diagram. Gray iron castings are made on one side of the main gangway and steel castings are made on the other side. All lifting and handling of sand, flasks, metal and castings is done by over head electric traveling cranes, a long monorail and stationary hoists serving the larger molding machines.

Under the conditions existing in this plant it has been possible to arrange the sand hoppers in such a manner that they can be filled from containers suspended from the traveling cranes. The hoppers and other production stations are supplied with sand by the night man who has the necessary available time.

The bay for bench and squeezer work is served by a 5-ton traveling crane made by the Harnischfeger Corp., Milwaukee. The crane moves sand and castings in the gray iron section of the bay and keeps the hoppers supplied with sand in the steel molding section. This bay also is equipped with seven ladles suspended from single steel members supported on the same tracks as those used by the traveling crane. These give complete coverage even where a large number of molds are on the floor. The ladles easily are filled from the monorail extending from the furnaces and around the outside of the main bay and the molding machine bay. The ladles also may be filled from a ladle suspended from the traveling crane in the molding machine bay if that is desirable for any reason or when the amount of metal to be distributed is in comparatively small volume.



DIAGRAMMATIC LAYOUT OF FOUNDRY

Below—View taken at approximately the center of the main bay looking toward the steel foundry. The main gangway and car track are just beyond the molding sand heaps. Above—Rough sketch showing general location of various departments

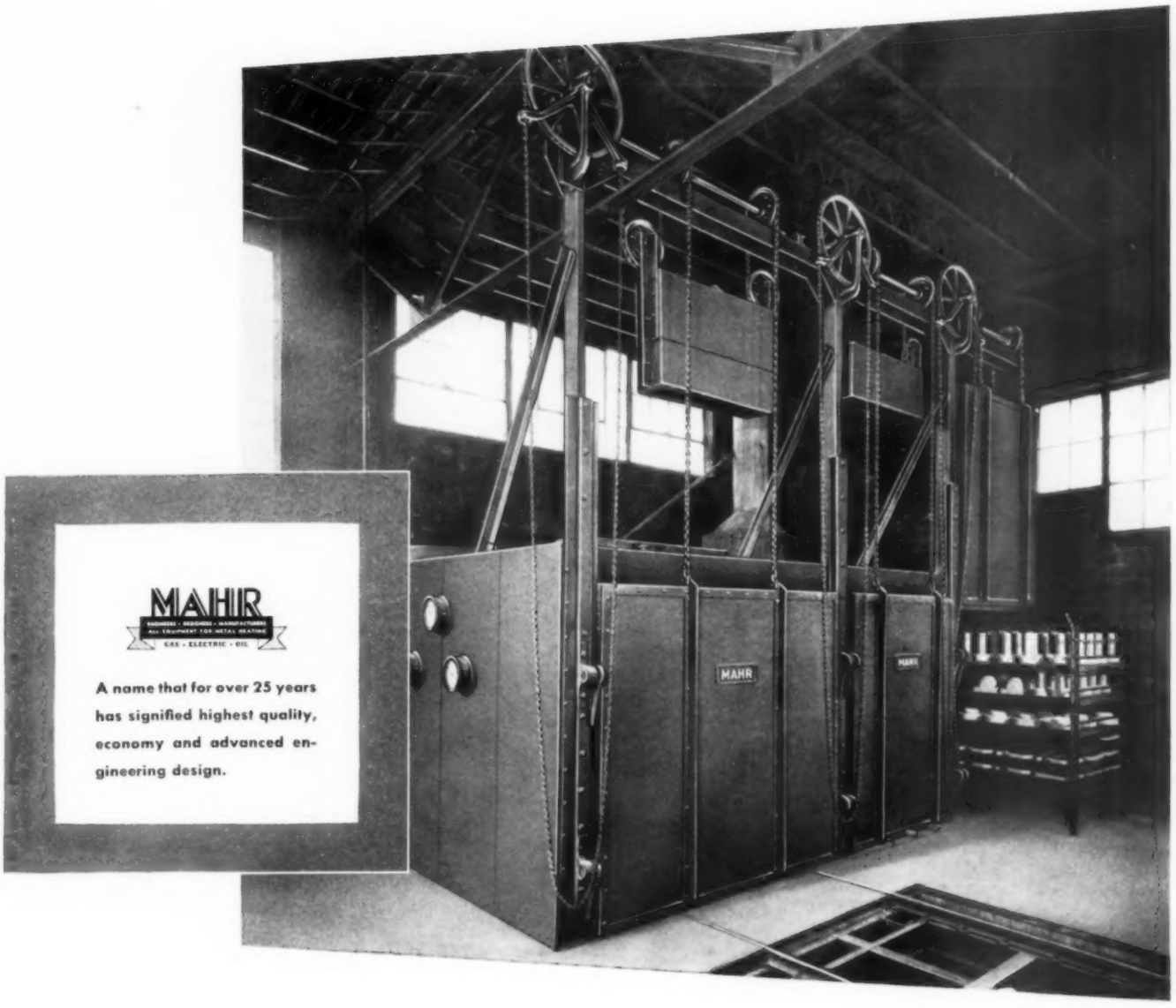
Crane Handles Materials

The molding machine bay is spanned by two 5-ton Harnischfeger cranes which handle all the materials including the castings, flasks made by the Sterling Wheelbarrow Co., Milwaukee. The operator on one crane has the responsibility of keeping the sand hoppers filled over the molding machines in this bay made by the Johnson & Jennings Co., Cleveland and by the Herman Pneumatic Machine Co., Pittsburgh. The sand hoppers are directly underneath the crane cab so that the operator at all times can note the amount of sand.

The main bay where the heavier castings are made is spanned by three traveling cranes, one of 10 tons and the other two of 15 tons lifting capacity. Molds in the steel section are made on a battery of three rollover jolt machines, two with a lifting capacity of 1000 pounds each and the third with a lifting capacity of 3000 pounds made by the Herman Pneumatic Machine Co. Flasks and molds on the largest machine are handled by one of the Sullivan Machinery Co. pneumatic hoists on a jib crane. A small electric hoist on another jib crane performs similar duty on the two 1000-pound machines.

Backing and facing sand mixing equipment is located near the upper end of the first bay as shown in the

(*Concluded on page* 120)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YOUR FOUNDRY today stands as the very foundation of this defense program. From it flow the castings that become basic parts of important armaments and machines . . . SPEED is on every tongue. "Give us speed", cry the men on the front lines. "Hurry", plead the men who make things for these other men . . . Your foundry today is geared to fast production. Your men work hurried hours. Losses of any kind—time or materials—are waste. In making cores, you can't afford "throw outs". MAHR OVENS help prevent waste by assuring perfect baking *the first time.*

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DIAMAHR

MAHR MANUFACTURING CO.
DIVISION OF DIAMOND IRON WORKS, INC.
MINNEAPOLIS, MINNESOTA, U. S. A.

(*Concluded from page* 118)
illustration. Where the castings are shaken out the sand falls through a grating in the floor on to a short belt which discharges into the boot of a bucket elevator. The sand passes over a magnetic pulley and through a revolving riddle into a hopper. Measured amounts are mixed and discharged from the mixer into steel buckets which are loaded on flat cars and moved on the narrow gage railroad to the main gangway where the crane picks them up and discharges the sand at any desired point. The facing sand mixer is operated practically in the same manner. The hopper is filled by the crane. A smaller hopper equipped with a screen below the main hopper, measures the amount and removes fines and dust. The measured amount flows by gravity into a smaller hopper. A small air hoist tilts one end so that the contents flow into the mixer. The sand is drawn off in buckets and delivered by crane to the various molding machine hoppers.

Large molds for iron or steel castings are made on a 10-ton Herman Pneumatic machine located in the main bay near the central gangway. A battery of three somewhat smaller machines are located at the lower end of the main bay. Flat cars loaded with cores, flasks or castings on the central track are pulled by one of the cranes or by an air hoist mounted horizontally. Loaded cars leaving the cleaning room are pushed by one of the electric trucks. The cleaning room is serviced by two 10-ton cranes. The core room in a half bay adjacent to the main bay also is served by two 5-ton traveling cranes.

The author expresses his thanks to James Prendergast, foundry superintendent, Sullivan Machinery Co., Claremont, N. H., for data supplied in the preparation of this article.

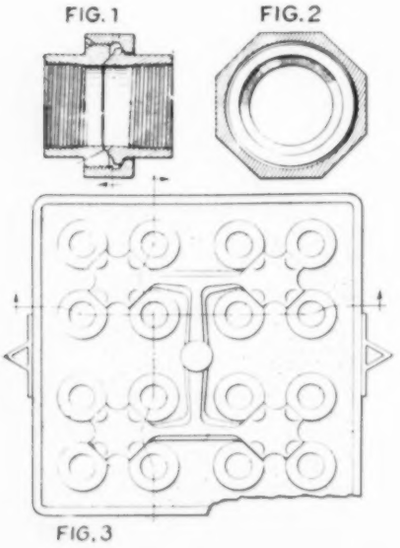
DEVELOPS IMPROVED TYPE NIPPLE

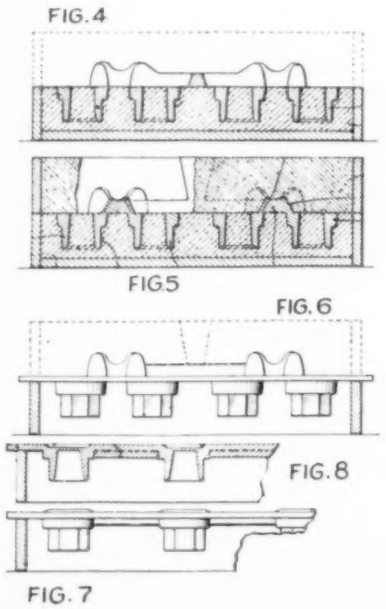
RIGHTS on what is claimed to be an improved method for making nipples for pipe unions recently have been obtained by Gordon W. Oremus, Medina, N. Y. Many details of the method for producing male and female castings from the same pattern plate are shown in the accompanying illustrations. Briefly summarized advantages of the new method include controlled directional solidification; elimination of mold shifts; castings need not be ground before they enter the machine shop; increased yield of castings through reduction is size of runner and gates; number of castings in mold increased; solid metal on top facilitates machining operation; pattern costs reduced; castings may be converted into either male or female, thus permitting the maintenance of a smaller stock of blanks, and elimination of necessity for counting the castings to preserve balanced stock of males and females; production of a finer and more uniform grade of castings.

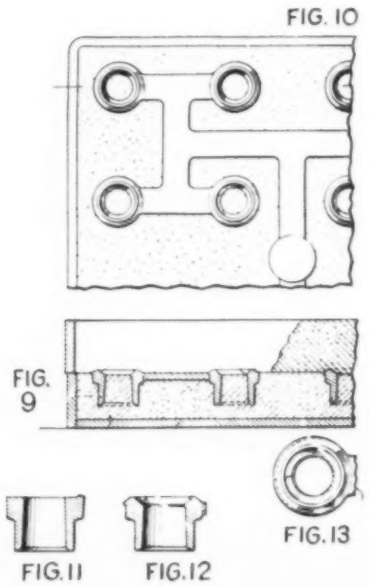
In the orthodox manner for making these nipple castings, the pattern plate had the patterns on the drag side, and the sprue and runners in the cope. One plates carries the distinctive male top on the cope side of the plate. A second plate carries the tapered depressions to form the ends in the female items. With this system of gating the metal enters the various small mold cavities horizontally at the top or joint edge. This method is claimed to involve expense on account of the reduced number of patterns in a flask, necessity for grinding fins and burrs at the joint, necessity for grinding gate stumps; selecting and counting a corresponding number of male and female castings before commencing machining operations.

Describes the Illustrations

In the new method all the foregoing objections are said to be eliminated. In the accompanying illustrations Fig. 1 is a longitudinal section of a complete pipe union or coupling. Fig. 2 is a cross section on line 2-2 Fig. 1. Fig. 3 is a top plan view of a drag showing a plurality of the nipple blanks cast therein. Fig. 4 is a vertical cross section of the same taken on line 4-4 Fig. 2, showing the cast blanks within the drag, and with the cope removed. Fig. 5 is a vertical longitudinal section taken on line 5-5 Fig. 2 showing the cope assembled with the drag. Fig. 6 is a vertical section showing the drag in full lines, the cope in dotted lines, and a matchplate between with the nipple blank patterns on one side and the sprue and runners on the opposite side. Fig. 7 is a fragmentary sectional elevation of an old matchplate on which the pattern, runner and gates are on the drag side. Projections on the cope side form the ends on the male castings. Fig. 8 is a similar view showing the matchplate arranged for casting female type items. Fig. 9







is a fragmentary vertical section of a flask showing the manner in which defective tubular nipples result from the patterns shown in Fig. 7. Fig. 10 is a fragmentary plan view of the drag and castings shown in Fig. 9. Fig. 11 is a longitudinal section showing the superior form of cast tubular nipple blank made from the new type plate. Fig. 12 shows a defective nipple made from an old type plate in a flask with loose pins. Fig. 13 is a plan view of the nipple shown in Fig. 12.

The numeral 28 represents a coupling sleeve surrounding the opposing ends of the male and female nipples. When this sleeve is drawn up tight, the ends of the opposing nipples form a tight joint. Although in the finished form the ends of the nipples are different, the castings on the matchplate are all alike. They are plain on top. The female recess or the male projection is cut by a machine in the machine shop. All the patterns are mounted on the drag side of the plate. Pattern for the runner and gates is mounted on the opposite or cope side. The gates deliver metal over the ends of the cavities in the drag and leave only a small stump when each casting is removed. It is claimed that it is not necessary to grind this stump. The same operation that forms either a male or female end on the casting, also removes the small gate stump, which is left as previously mentioned.

Cites the Claims

Claims for the invention include a method for producing cooperating male and female nipples for pipe unions which consists of preparing a mold for casting nipple blanks of identical form and in which the mold cavities for the sides and rear ends of the nipples are formed wholly in the drag of the mold, and only front ends of the mold cavities and the passageways for introducing the metal are formed in the cope; pouring molten metal through the runners and gates in the cope and into the mold cavities in the drag to produce nipple castings of identical form, each of which has a fin only on the front end; machining the front ends on some castings and removing the fins therefrom to form the front ends into female faces. Machining the front ends of other castings into male faces.

Firm Changes Name

Lyon Iron Works, Greene, N. Y., manufacturers of material handling equipment, and established in 1840, has changed its name to Lyon-Raymond Corp. The company will continue under the same management with George G. Raymond as president.

LOOKING FOR THESE IN
DUST CONTROL?
• HIGH EFFICIENCY
• LOW INITIAL COST and UPKEEP
• WET DUST DISCHARGE
You can get ALL 3 with an
AMERICAN "DUSTUBE" or
Cyclone DUST COLLECTOR
YOU can have high efficiency (averaging above 98%), low initial cost, and the low maintenance that goes with simple construction by installing an American "Dustube" cloth bag type dust collector. The American "Cyclone" ranges lower in cost than the "Dustube" and its efficiency is not quite so high on extremely fine dust, but it does equal that of the average wet system and it is much less costly.
By adding an American Wet Disposal Unit to the "Dustube" or the "Cyclone" you can discharge accumulated dust as a wet sludge. You will find it less costly to operate than the average wet system because there is not a continuous flow of water (the disposal unit operates only when dust is discharged); and the sludge does not require dewatering.
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FOUNDRY EQUIPMENT CO.
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FOUNDRY ACTIVITIES

BAHAN TEXTILE MACHINERY CO. INC., Greenville, S. C., recently placed in operation a gray iron foundry 62 x 600 feet, with an extension at one end for core room and pattern shop the same width and 100 feet in length. The property is an 18 acre plot about 6 miles outside Greenville on the Spartansburg road, on the Southern railroad and on the site of the old army camp Sevier.

* * *

Modesto Foundry Inc., Modesto, Calif., is rebuilding its foundry recently damaged by fire.

* * *

N. S. Foundry, 1140 Elliott avenue West, Seattle, is building an addition 25 x 53 feet.

* * *

Barberton Foundry Co., Barberton, O., is adding two bays at an approximate cost of $9000.

* * *

Draper Corp., Hopedale, Mass., has let contract for a four-story 140 x 300 foot addition to cost approximately $350,000.

* * *

Magnesium Products Co., 1127 South Boyle avenue, Los Angeles, Calif., is building a plant 52 x 62 feet, costing $6000.

* * *

Berlenbach Foundry Co., formerly of Quakertown, Pa., has moved into its new plant at Shelly, Pa. (Noted September.)

* * *

McKinnon Industries Ltd., Ontario street, St. Catharines, Ont., is building a plant addition to cost $100,000 with equipment.

* * *

American Steel Foundries Co., Alliance, O., is taking bids for a plant addition to cost more than $500,000.

* * *

L. J. Mueller Furnace Co., Milwaukee, recently has enlarged its plant through a 6000-square foot addition.

* * *

Middle States Foundry & Mfg. Co., Milwaukee, has let contract for a one-story plant addition 50 x 121 feet.

* * *

Acme Steel & Malleable Iron Works, 245 Military road, Buffalo, is rebuilding and enlarging its foundry which recently was damaged by fire. The office, pattern and machine shops are being moved to a building on Chandler street. Alfred F. Grone is vice president and general manager, and John Goetz is foundry superintendent.

* * *

Waukesha Foundry Co., Waukesha, Wis., is building a one-story

Simplicity

FOUNDRY EQUIPMENT

hold a key position in casting production

This is shown by the statements recently made in writing by many of our users. Shown below are a few excerpts from some of these letters.

★ ★ *"I sincerely believe that without the use and continued operation of the Simplicity shake-outs now in our plant, that it would lower our production between ten and twenty percent."*

★ ★ *"Your machines not only save labor during the shake-out operation, but we find the greatest savings in flask equipment and the castings come truer to form, particularly when shaken out hot."*

★ ★ *"We believe the Simplicity Equipment is one of the most vital in the Foundry Industry today."*

★ ★ *"We are using your Portable Screening and Conditioning Unit and couldn't do without it under the present conditions. In fact we saved the price of the machine in six months time on man hour savings alone."*

SIMPLICITY ENGINEERING CO.

DURAND, MICHIGAN

For Canada: Waterous Limited, Brantford, Ontario

plant addition to be used as a cleaning room.

* * *

William Kennedy & Son. First avenue, Owen Sound, Ont., is building an addition to its plant to cost about $700,000 with equipment.

* * *

Deere & Co., Davenport, Iowa, has given contract to J. H. Hunzinger & Co., Davenport, for a two-story foundry to cost about $150,000.

* * *

Bishop & Babcock Mfg. Co., 4901 Hamilton avenue, Cleveland, has reopened a plant at East Fifty-fifth street and New York Central railroad to provide facilities for large shell contract. Equipment to value of $900,000 will be government financed.

* * *

Minneapolis-Moline Power Implement Co., Minneapolis, is building a one-story foundry addition 50 x 375 feet.

* * *

Saginaw Malleable Iron division of General Motors Corp., Saginaw, Mich., has let contract for a 1-story foundry addition to cost $50,000.

* * *

General Magnetic Corp., 2126 East Fort street, Detroit, is rebuilding its foundry recently damaged by fire. Equipment has been purchased to replace that damaged by fire. A. J. Thiery is foundry manager.

* * *

Reliance Foundry Co., 1933 Macomb street, Detroit, has been incorporated by Howard Neuman, 4324 Fifth street, Ecorse, Mich.

* * *

E. G. Soeth Co. Inc., until recently located at 384 Seventh street, San Francisco, has moved to 760 Twenty-third avenue, Oakland, Calif.

* * *

Elyria Foundry Co., Elyria, O., subsidiary of Industrial Brownhoist Co., is building a 13,000-square foot castings cleaning building.

* * *

Bendix Aviation Corp., South Bend, Ind., will build a 180 x 400-foot magnesium foundry costing about $500,000; contract to the Austin Co., 19 Rector street, New York.

* * *

Kennedy Van Saun Mfg. & Engineering Co., Danville, Pa., will build a 100 x 200-foot manufacturing building; contract to Austin Co., 19 Rector street, New York.

* * *

James Hunter Machine Co., Main street, North Adams, Mass., is building a two-story 42 x 135-foot plant addition. Estimated cost is $55,000.

* * *

Worthington Pump & Machinery Corp., Buffalo, has built a one-story addition to its pattern shop, 120 x 202 feet, and which cost approximately $100,000 with equipment.

* * *

Quality Engineering Inc., Box H, Van Dyke, Mich., has been incorporated with 50 shares no par value to deal in metal stampings and wood patterns by James A. Covert, 7283 Lozier street, Van Dyke, Mich.

* * *

Hays Mfg. Co., 801 West Twelfth street, Erie, Pa., will build a one-story, 50 x 200-foot addition; contract to Henry Platt Co., 922 Raspberry street. Cost estimated at $40,000. H. Nelson, Hayes building, is engineer. (Noted September.)

* * *

Singer Sewing Machine Co., Trumbull street, Elizabeth, N. J., has let contract for a one-story, 400 x 600-foot manufacturing building at Bridgewater, N. J., to Austin Co., 19 Rector street, New York.

* * *

Wagner Brass Foundry Inc., 2020 Holly street, Chicago, has been incorporated with $20,000 capital to manufacture brass, bronze and iron castings, by O. Wagner, R. O. Wag-

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100% UNIFORM

DRUM CARLOAD TANK-CAR

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•

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DOCO BINDER AND CORE PASTE

DOCO STEEL CORE AND MOLD WASH

THE DAYTON OIL CO.

Factory and General Offices

DAYTON, OHIO

ner, and F. A. Wagner.

* * *

Clifford A. Brickner, who formerly operated a brass works in Tiffin, O., has let contract for the construction of a new brass and aluminum foundry in Tiffin.

* * *

Ford Motor Co. of Canada Ltd., 2790 Sandwich street, Windsor, Ont., has given contract to Dinsmore-McIntyre Ltd. for erection of foundry addition, 225 x 280 feet, to cost about $130,000.

* * *

Valley Iron Works Co., 401 East South Island street, Appleton, Wis., has begun construction of a one-story plant addition. The company manufactures gray iron, brass and aluminum castings, and paper and pulp mill machinery.

* * *

Lloyds Foundry Castings Corp., formerly located at 123 West Sixty-fourth street, New York, recently has moved its office and foundry to 400 Hoover avenue, Bloomfield, N. J.

* * *

Michigan Pattern & Mfg. Corp., 3641 East Milwaukee avenue, Detroit, has been incorporated with $50,000 capital to manufacture metal and wood patterns, by David C. Lowe, Grosse Pointe Woods, Mich.

* * *

A new foundry building is being erected at 938 East Sixtieth street, Los Angeles, Calif., for the Rogers Pattern & Foundry Co. It will cover an area 42 x 60 feet.

* * *

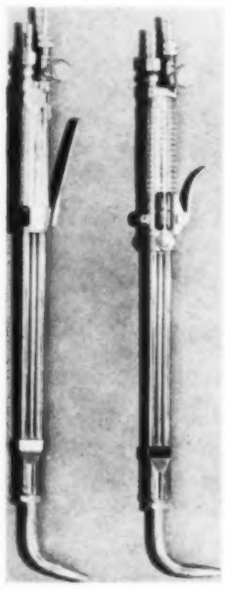
Clearwater Foundry & Machine Works, Lewiston, Idaho, recently was damaged by fire. Victor Van Dyke, owner, plans to rebuild and re-equip plant as soon.

Foundry Has Party

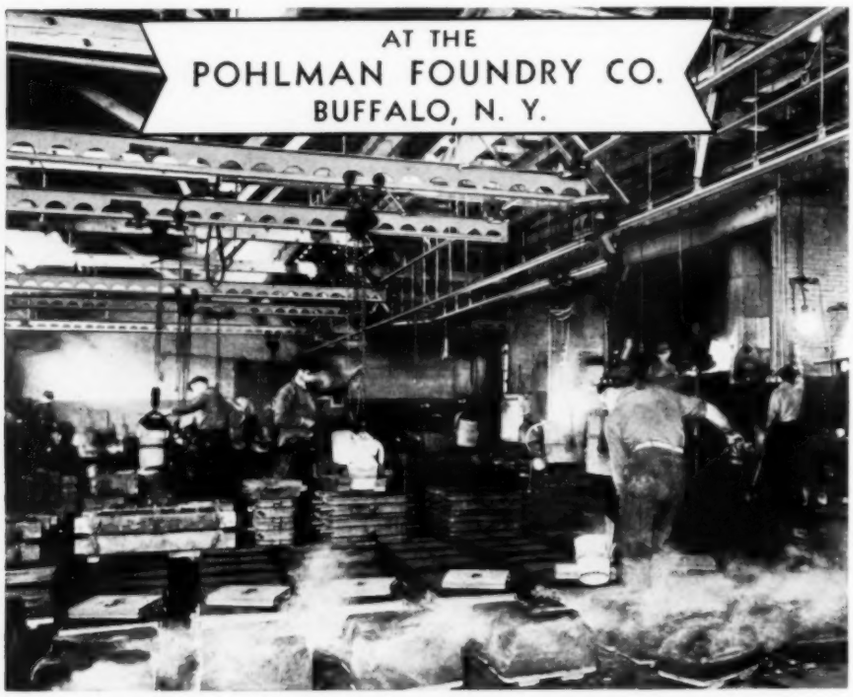
Approximately 200 guests attended the annual open house party held by the Youngstown Alloy Casting Corp., Youngstown, O., on Aug. 23. Jack Trantin, president of the firm assisted by members of his staff and J. M. Lathrop, THE FOUNDRY, Cleveland, entertained the guests.

Riser Cutters

Air Reduction Co., New York, has designed a new line of hand cutting apparatus shown in the accompanying illustration for cutting risers and other applications. It consists of two torches and three tips. The torches are straight head type with monel metal heads and stainless steel tubes, and are 21 inches long. Cutting oxygen can be controlled either by a lever or trigger, and



the type selected may be placed at top, side or bottom of torch to suit convenience of operator. New cutting tips are known as style 187 bent to 75 degrees; style 181 bent to 90 degrees and style 191 which is straight. The latter is not illustrated.



THIS CLEVELAND TRAMRAIL SYSTEM HAS BEEN
GROWING SINCE 1926

Mr. E. A. Piper, Foundry Engineer, says, "We here at Pohlman are pretty much sold on Cleveland Tramrail."

The first installation of Cleveland Tramrail was purchased by the Pohlman Foundry Co. in 1926. Every few years since that time their system has been extended. More rail here — another crane there — perhaps a few new chain or electric hoists.

Obviously overhead materials handling equipment has proven advantageous to Pohlman. Equally obvious must be the fact that Cleveland Tramrail has been serving this company satisfactorily for 15 years.

For quality overhead materials handling equipment there is nothing better than Cleveland Tramrail.

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THE CLEVELAND CRANE & ENGINEERING CO.
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OVERHEAD MATERIALS HANDLING EQUIPMENT
Other products: CLEVELAND CRANES and STEELWELD MACHINERY

Obituary

HAROLD J. STEIN, director of research, chemistry and metallurgy at the Allis-Chalmers Mfg. Co., Milwaukee, died Sept. 9 at the age of 47. Mr. Stein directed these activities since 1939, when they were consolidated into one department upon the retirement of R. S. MacPherran, chief chemist. He came to Allis-Chalmers as a student apprentice in 1916, served in various manufacturing departments and was in turn made general foreman of the company's heat treating operations, assistant foreman of the forge department and later a research engineer. In 1936 he was made chief research engineer of all the manufacturing departments of Allis-Chalmers. Mr. Stein was born in Philadelphia. He attended Tri-State college at Angola, Ind. For many years he had been a member of the American Society of Testing Materials, the American Foundrymens' Association and the American Society of Metals.

Harold J. Stein

* * *

Orlande Hamilton, 85, for several years owner of an iron foundry at Goshen, Ind., died recently in Detroit.

* * *

William H. Schulte, 81, for many years president, Trenton Brass & Machine Co., Trenton, N. J., died Aug. 28.

* * *

Robert McNutt, 45, office manager, Continental Roll & Steel Foundry Co., Pittsburgh, died Sept. 7 at Suburban hospital in that city.

* * *

Carl C. Back, 72, president of the Manufacturers Iron Foundry, Bridgeport, Conn., died in Boston recently. Before becoming associated with the Manufacturers Foundry, he was interested in the Pequonnock Iron Foundry and the Harbor View Foundry. He worked with the late Henry H. Sprague, Sprague Meter Co. in designing and making the first cast iron gas meters placed on the market.

* * *

Alvan T. Simonds, 64, president and general manager, Simonds Saw & Steel Co., Fitchburg, Mass., and president, Abrasive Co., Philadelphia, died Sept. 2.

* * *

Samuel Duncan Strong, 73, for many years president and general manager, Homer Furance & Foundry Corp., Coldwater, Mich., died Aug. 19. Mr. Strong was credited with having invented a pipeless furnace.

* * *

Merlin Kramer, 42, research engineer and an assistant superintendent, West Pullman Works, International Harvester Co., Chicago, died at his home in that city, Aug. 20.

* * *

Walter D. Sayle, 80, president, City Foundry Co., Cleveland, and other firms including Cleveland Punch & Shear Works, Cleveland; Cleveland Crane & Engineering Works, Wickliffe, O., and the Ohio

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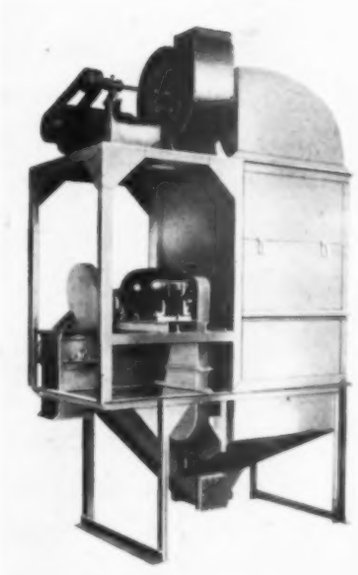

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625 E. FOREST AVENUE **DETROIT, MICHIGAN**

Machine Tool Co., Kenton, O., died in Cleveland on Sept. 5. In 1890 Mr. Sayle organized the Cleveland Punch & Shear Works, and 7 years later founded the Cleveland Crane & Engineering Works. In 1903 he purchased the City Foundry Co., and the Ohio Machine Tool Co. in 1911.

* * *

Eckhart H. Brandis, 51, works auditor, American Steel Foundries, Hammond, Ind., died at his home in Lansing, Ill., Aug. 26. He has been associated with the firm since 1912.

* * *

J. C. Maben Jr., 70, retired vice president, Sloss-Sheffield Steel Co., Birmingham, Ala. died recently at his home in Carters, Ga. Mr. Maben was born in New York and attended Columbia College and the Colorado School of Mines.

* * *

Edward John Haman, 57, superintendent of the permanent mold division at the Cleveland plant of the Aluminum Co. of America, died Aug. 20, in Cleveland.

* * *

Sherman S. Jewett, 71, president, Jewett Stove & Foundry Corp., Buffalo, for 21 years, died Aug. 22. Mr. Jewett, whose grandfather founded the company in 1836, had invented and patented several devices now in use on gas and coal stoves. An attorney, Mr. Jewett retired from active practice to assume the vice presidency and management of the stove company in 1916 and was elected president in 1920.

* * *

James C. Lenahan, 49, purchasing agent, Philadelphia plant, Link-Belt Co., died recently in Ocean City, N. J. Mr. Lenahan had been associated with the company for 36 years.

* * *

Richard O. Allexan, 44, president and treasurer, J. S. Heath Co., manufacturer of architectural bronze, North Chicago, Ill., was killed Sept. 7, when struck by lightning on his estate at Wadsworth, Ill.

* * *

Harold A. Osborne, 54, vice president, general manager and director, United Shoe Machinery Corp., Boston, died Sept. 7 at his home in that city. Mr. Osborne held directorates in the Little Way Process Co., United Shoe Repairing Co., and other firms.

* * *

John Morse, 25, assistant manager, San Francisco office, Fairbanks, Morse & Co., Chicago, and son of Col. Robert H. Morse, president of the company, was killed Aug. 22, in an automobile accident at San Rafael, Calif. He graduated from Yale University in 1937.

* * *

L. S. Kerchner, 61, died at his home in Pittsburgh on Aug. 15. Mr. Kerchner was associated with the American Manganese Mfg. Co., now Dunbar Corp., many years, prior to establishing his own sales agency for pig iron, coke and sand in 1920. In 1922 with R. M. Marshall, he formed the partnership known as Kerchner & Marshall, and six years later the company was incorporated as Kerchner, Marshall & Co., with offices in Pittsburgh and branches in Cleveland and Detroit.

* * *

Edward M. Taggart, 76, veteran sand and foundry supply salesman in the northern New Jersey district, died recently at his home in East Orange, N. J., following six weeks' serious illness. Mr. Taggart had been active in the district for 35 years, originally representing J. W. Paxson Co., then Paxson-Taggart Inc., and finally for the past eight years, Taggart & Co., all of Philadelphia. During the latter period he also represented the Pennsylvania Foundry Supply & Sand Co., another Philadelphia concern, selling sand for Taggart and various other foundry supplies for the Pennsylvania Foundry company. His son, M. R. Taggart, heads Taggart & Co.

ANNOUNCEMENT

★ ★ ★

Effective August 30th, 1941, Milwaukee Chaplet & Manufacturing Company acquired the complete business of the Standard Chaplet Manufacturing Co., Rock Island, Illinois. All of the manufacturing facilities have been moved to the Milwaukee Chaplet plant, Milwaukee, Wisconsin.

ANOTHER STEP FORWARD

We pledge ourselves to render the same fine service that we have given the foundry-trade for over twenty years. We shall continue to increase our production facilities and service to meet the requirements of foundrymen who demand the best.

★ ★ ★

PRODUCING ENGINE CASTINGS

(*Continued from page* 60)

tween the inner and outer patterns. To equalize the filling speed of both rings, four gates connect each runner with the larger outside ring, while three similar gates on the inside deliver metal to the inner ring.

Pattern for the smallest ring, that is the ring for the high pressure cylinder is mounted in the same manner as the others. Sprue and runner are in the center with the runner extending a few inches past the two gates entering the mold at right angles to the flow of the stream in the runner. The first dash of iron carrying any small amount of dust or other light foreign material flows to the dead end of the runner and remains there while clean metal from the filled runner flows through the gates into the mold.

Blacked and Dried

With the exception of some of the smaller molds made in the second or auxiliary bay of the foundry, all molds are blacked and then dried on cars in large gas fired ovens. Some of the larger molds are made in the floor and dried with gas jets. For several reasons this method of molding is not practiced as widely as formerly when nearly all the large molds were made in this manner.

Over a period of years new flasks have been added to the supply and large jolt ramming machines have been installed with sufficient capacity to handle the heaviest flasks either empty or filled with sand. In recent months with the shop jammed with work of all kinds this feature, like many others introduced by ingenious foundrymen from time to time, has been taken advantage of in a manner not contemplated originally. After the castings are poured, the molds are loaded on railroad flat cars, hauled out on temporarily unoccupied spurs of railroad tracks and left there for varying periods until the castings have cooled.

They are hauled back into the foundry as opportunity presents. Castings are extracted and laid down on the cleaning room floor, a large open space near one end of the main bay; sand is shaken out and prepared for further use and the flasks either are stacked, or placed on the pattern boards where the entire sequence is repeated. The arrangement provides additional room for molding, and reduces the temperature in the shop during and after the casting period from noon until quitting time in the evening.

Method of molding, coreing and gating pistons and cylinder heads for the low pressure cylinder are shown in Figs. 6 and 4 in the September issue. Method of gating is the same in both instances, two sprues, two deep runners in the drag face supplemented by corresponding channels in the cope face, and four shallow gates connecting each runner with the mold cavity. Great care and a high degree of skill are required in making and setting the cores in these molds. In the cylinder head Fig. 4 the cores are supported on chaplets and then bolted firmly to the cope face. In Fig. 6 the cores of the piston rest on chaplets in the drag and also on two small core prints for each core at the perimeter of the mold.

Additional chaplets are placed on the top faces before the mold is closed, to prevent the cores from rising when the mold is filled with molten metal. The coremaker is confronted with two difficult features in making these cores. Each core section is entirely surrounded

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with metal during the pouring process with the single exception of the two small openings at the rim. All the vent from each section has to pass through a small vent in these prints. In cleaning the casting all the sand and all the rods must be removed through the same two small holes. The cores must be strong and stiff to withstand pressure against the top chaplets. A very nice combination indeed to test the skill of coremaker and molder. (Bud) Carter, foundry superintendent at Mt. Vernon, and Dave Whyte, general superintendent foundries and pattern shops Mt. Vernon and Grove City plants Cooper-Bessemer Corp., admit that in a wide and varied career they have handled simpler jobs.

Castings for the high pressure cylinders 28¾-inches diameter, weight 15,000 pounds, intermediate cylinders 35 inches diameter, weight 16,500 pounds, and liners, are made at the Grove City, Pa., plant of the Cooper-Bessemer Corp., in a foundry 600 feet in length and 100 feet wide and with a core room extension at one side approximately 100 x 100 feet.

To cope with the greatly increased volume of work incident to the production of 126 sets of marine engine castings in a limited period, new flasks had to be cast and machined and the core room had to be re-laid out and re-equipped. The cylinders are molded and cast in a horizontal position as shown by the parting line on the accompanying illustrations, Figs. 13, 14, 15, 16, 17, 18 and 20, approximately one half in the drag and the other half in the cope. Sand in these and other large molds is rammed under a locomotive type sand slinger made by Beardsley & Piper Co., Chicago. The machine moves backward and forward on a section of railroad track bedded in the foundry floor while the flasks are set up on both sides within reach of the swinging arm.

The patterns are faced with a black sand mixture containing small amounts of pitch base compound core binder. Amount of binder, also moisture content, grain size and permeability vary to some extent from time to time as dictated by advice from the laboratory where close daily check is kept on molding and core sand, and—when necessary—on all raw materials involved in the production of molds and cores.

Use Two-part Flask

The mold is made in a two part flask, but with each half pattern mounted on a board and adjusted accurately on center lines so that both halves of the mold will coincide when the finished cope is placed on the drag containing nearly all the cores. The molds are made in one section of the main bay, finished and blacked and dried in large car type ovens. The dried molds are set up for casting in pits near the center of the main bay. Drag and cope are alike in that each is provided with a full set of bars and no bottom plates are needed.

It is claimed this greatly facilitates the drying process and presents other advantages readily apparent to any foundryman familiar with the production of large castings in dry sand molds. Close examination of the photographic reproduction will show that no time is lost in producing a piano finish on the flat end of the cylinder pattern or mold. In service this is the upper end of the cylinder and is machined to a flat, true surface for the reception of the cylinder head casting.

Core sand is stored in bins at one side of the core room in the vicinity of the mixers and is trucked to various points on the floor as required. Some cores are jolted on machines, but the majority on account of inserting arbors, reinforcing rods, hooks and vents, are rammed by hand with hand or pneumatic rammers. Recent changes in the core

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FAST, ACCURATE STURDY
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NEW FEATURES
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room include removal of partitions, raising the roof, installation of a crane and substitution of the most modern type of ovens made by the Foundry Equipment Co., Cleveland, for a number of units in use for many years and far behind the new ovens in speed and general efficiency. An interesting feature in connection with these major operations is that work went on as usual and full core production was maintained during the entire period. Any person who has had a similar experience, and they have been more numerous than usual in the past year, readily will recognize the work of a master foundryman.

To insure a perfectly clean surface on the inside of pistons and piston valves, the surface of each core is covered with a high grade blacking. An agitator in the blacking container maintains the liquid at constant density. The core is not painted with a brush or swab. It is dipped into the tank and revolved several times to insure a universal, even coating. The casting cleaner has no difficulty in removing every particle of sand from the main part of the casting, and what is more important, from the enlarged chamber at the end of the casting connected to the main part of the core by a small diameter neck. The castings are machined to a mirror finish which would be ruined quickly if even a single grain of sand remained on the inside to work loose when the engine is in service.

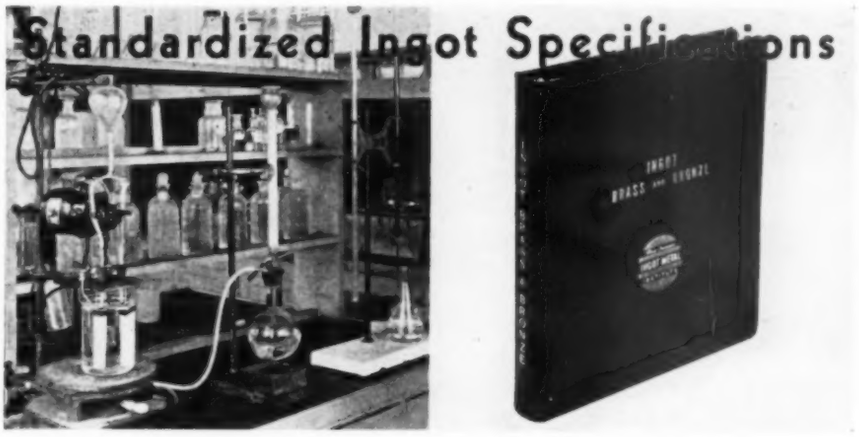
Molded Horizontally

High pressure cylinder liners and high pressure valve liners are molded in a horizontal position, dried and cored, then closed and lifted to a vertical position before the molds are filled with metal. The larger castings are molded singly, while smaller castings are molded four in a flask. A single pattern serves for each pair. The core for each pair is a single unit supported in a wide print in the center. The core is gripped tightly in this print and requires no further anchorage.

Metal is poured into a green sand basin on top of the upended mold and enters a sprue opening, which in the practically universal custom of the foundry, is sealed temporarily with an iron plug. When the basin is filled the plug is removed and the iron flows down to a point slightly below the center line of the two castings. Here it enters a small reservoir or settling basin designed to catch any floating foreign material. Clean iron enters the mold cavities through small gates at the upper edge of the basin liners and large pistons are molded singly and are poured through a ring of pop gates.

Method of gating the high pressure and intermediate cylinders is shown in several of the accompanying illustrations. Sprues on opposite sides of the cope for the accommodation of two ladles poured simultaneously deliver iron to small catch basins in the joint face of the drag, back of the steam chest core on one side, and in the opposite corner at the closed end of the cylinder. Metal from the sprue runs up hill in the drag runner, then drops and runs under a flat core set on edge at the entrance to a reservoir or settling basin and thence through small gates into the mold at the bottom and at the joint of the mold. The uphill travel, the pause while going under the vertical core and the further temporary stoppage in the reservoir effectually hold any stray or accidental foreign materials in the flowing stream before the metal enters the mold cavity. The metal also is poured at high speed to prevent the formation of dirt or sullage which possibly might become trapped in any of the highly intricate passages between the cores to form a defective spot or area in the finished casting.

The magnitude of the job, the apparent ease and speed with which



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The result is ingot metal and practical technical follow-through in which, *as always with Ajax*, you have implicit confidence.

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these large and highly intricate castings are turned out at the rate of one per day, can be appreciated properly only by foundrymen who have handled similar jobs in the past, who have contemplated or are contemplating bidding on similar jobs in the present or future, or who take a proper and legitimate skilled craftsman's pride.

This is the second and concluding article covering certain phases of foundry practice adopted by the Cooper-Bessemer Corp., with shops at Mt. Vernon, O., and Grove City, Pa., in the production of triple expansion marine engine cylinders and other castings. The first article appeared in the September issue of THE FOUNDRY.

THE EDITORS.

Adventures of Bill

(*Concluded from page 92*)

zance must be taken of the fact that the pipes act as chills. Hot metal will not melt the pipes, except where a stream flows persistently against them. Gates should be arranged with this feature in mind. However, a danger exists that the wall of the pipe may collapse under the combination of pressure and high temperature in a thick casting. To offset this hazard it is advisable to pack the pipe with dried molding or sharp sand in which approximately 10 per cent sawdust is incorporated. The sawdust is consumed by the heat and facilitates removal of the sand in the cleaning room. After the pipes are packed they are heated in the oven to drive off any residual moisture. Then they are sand blasted and given a light coating of shellac or kerosene oil to prevent rusting.

"The mold may be made either in green sand, skin dried sand or dry sand. Dry sand is preferable, since a green or skin dried mold may yield to a certain extent and produce a casting in excess of the required thickness. With proper care a green sand mold is satisfactory. An iron flask is preferable to wood, but a wood flask may be employed if it is braced with rails top and bottom.

"The ideal method is to pour the mold in a vertical position. This is not practical with green sand, but may be practiced with a dry sand mold in an iron flask, or with a mold made of two cores, one containing the impression of the pattern, while the second core merely is a flat slab to be used as a cope. The cores are reinforced either with rods laid longitudinally and transversely, or preferably with cast iron grids or arbors. After the pipes are set in place the two halves of the core are bound together, set up in a flask or pit, braced firmly and then enclosed in rammed sand.

"Metal enters the mold through a sprue at one end, extending to a long runner at the bottom and a number of small gates. When the mold is filled to a depth of approximately 6 inches, metal from a second ladle is poured into a long basin on the top and falls into the casting through five ¾-inch diameter gates spaced in a manner to permit the metal to fall into the spaces between the straight lengths of the pipe coils. With the metal rising uniformly around them the pipes will expand normally in a longitudinal direction. The pipes are suspended from the top prints and anchored in place to prevent them from rising.

"Where conditions prevent this type of molding and where the casting must be poured flat either in green or dry sand, the best method of introducing the iron is through a long double basin, with the two branches about 18 inches apart. Six ¾-inch pop gates in the bottom of each basin and through the cope at points that will clear the pipes, will fill the mold rapidly, one of the essentials in minimizing expansion of the pipes. A flow off riser at each of the four corners of the cope will allow a certain amount of metal to flow through and incidentally will drain the pouring basin."

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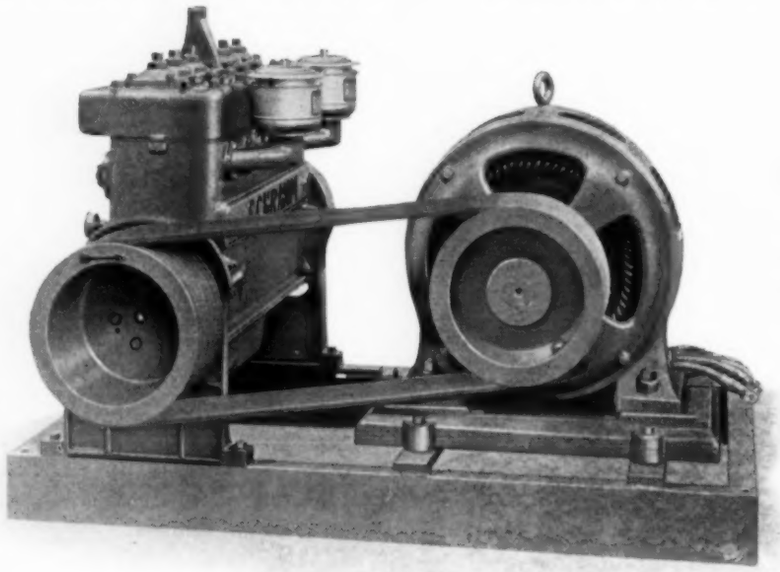

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STEEL FOUNDRY DRAMATIZES CASTINGS

(*Concluded from page* 52)

the difference between defeat and victory.

"Our tanks have been designed, developed, and built by the Ordnance Department, generously and ably assisted by the automotive and related industry. Lebanon Steel Foundry has given much time and thought to our problems.

"As I walked through the Lebanon Steel Foundry this morning, I could not help but be impressed with the appearance of your men at work; all keenly interested, careful but alert, scrutinizing every operation to see if molds and cores were properly rammed and gated; free from dirt and properly secured. I noticed your care in having the steel at the proper temperature; your care in shaking out castings and in chipping and grinding. Certainly there is no cut and try method in your heat treatment or in your laboratory. It is a plain indication to any observer how carefully every operation of your company is supervised.

"The success of the national defense program today depends squarely and solidly upon the shoulders of the women. They must shoulder those responsibilities for the duration. It is up to them—as it has been up to them through all the centuries—to "condition" their men for the tasks which they must do—in war, in peace, in peril.

"It is of the most vital importance that every American woman today do her utmost to assist her soldier or her workman—wherever—or whoever—he may be—by smiles, good-will,—and sacrifice. Perhaps the man who marches to the factory is not as spectacular as the who marches to war in a uniform. Perhaps some of the women may forget that an all-out effort on their part is as important to the men in American industry as it is to the soldier in training, in the field, or on the sea.

"America today needs her workmen as much as she needs her soldiers! Soldiers are of no use unless they have the equipment. Women! Smile to them—forget the nagging. Give them vitamins—not vitriol. Forget about silk stockings and gasoline. Forget about those vacation plans to Timbuctoo. Forget about the parties—and the late hours. Your man needs rest—and plenty of it. Rest, food, comfort and love—these your man needs. If you fail your man, you fail your country!

"The men have the skill and are willing to toil and sweat, and the women the willingness to sacrifice and love, so that our country may endure, our homes may be happier, and our children may be insured against slavery.

"Our Flag has been successful in every engagement, and we must preserve its reputation."

T. S. Quinn, treasurer, Lebanon Steel Foundry, presented gold buttons to 40 men who have been with the firm 20 years or more, and made them members of the Circle L Twenty-year Club of Lebanon. Previous to the parade contests for the children were held, and those for adults followed the parade. Other features of the outing included a baseball game between Lebanon Steel Foundry and Cornwall which ended in a score of 5 to 0 in favor of Cornwall; a band concert by the 25-piece Steel Foundry band under the direction of Charles Ditzler, and a minstrel show.

Peter Gamber was general chairman of the outing committee. Other members included Arthur Weinhold, Harry Mentzer, Charles Young, Harry Felty, John Umberger, Herbert English, Harold Light, Edward Rutter, James Blouch, Darwin Kohr, Mark Moore, and Grant Heim.

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MANUFACTURERS OF VIBRATING SCREENS, PACKERS AND FLEXIBLE COUPLINGS

TRAINING PROGRAM ARRANGED

(*Continued from page* 55)

were later changed to 4 hours. Since the installation of the training course, the national defense requirements recently have necessitated full plant operations on Saturday, 6 days a week. This has resulted in temporary abandonment of the regular weekly shop classes, but to date it has been possible to hold these classes at least once a month.

The instruction plan for the classroom work, for the 2-year period, has been divided into two classifications, namely direct and supplementary. Direct instruction deals with subjects intimately related to the usual foundry processes. These include blue-print reading, shop mathematics, sand, patterns, flasks, equipment, metal, foundry science and similar topics. The supplementary subjects are of a more general nature. They include foundry history, foundry economics, foundry management, foundry English, foremanship, plant policies, plant and job safety, personal economics, and civics.

Because of budget restrictions, it was necessary to confine the shop instruction to coremaking and molding. Instruction in patternmaking, elementary machine shop practice, and cleaning department methods was deferred temporarily.

The 2-year shop course outlined for the core room is designed to familiarize the student with all phases of coremaking, starting with core filing and advancing through core assembly, sand preparation, tools, simple bench coremaking, advanced bench coremaking, advanced power machine coremaking, buck and floor coremaking, and coreblowing.

Shop instruction in molding is divided into two classifications, light and medium, and heavy. The light and medium molding course provides advancement from simple bench molding to plain squeezer work, advanced squeezer work, simple cored squeezer work, complicated cored squeezer work, simple and advanced plain and cored work on large power jolt, strip, and rollover machines, and light floor molding.

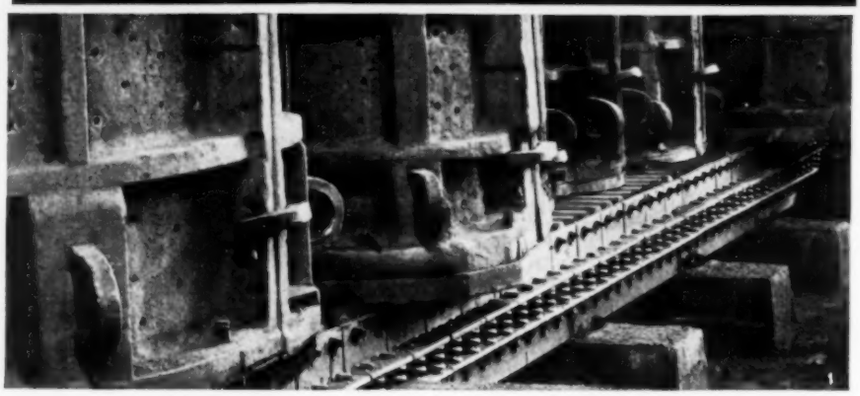
The heavy molding course outlines a program of instruction for tight flask work progressing through simple and advanced, hard rammed green and dry sand work to the same classifications rammed with the sandslinger.

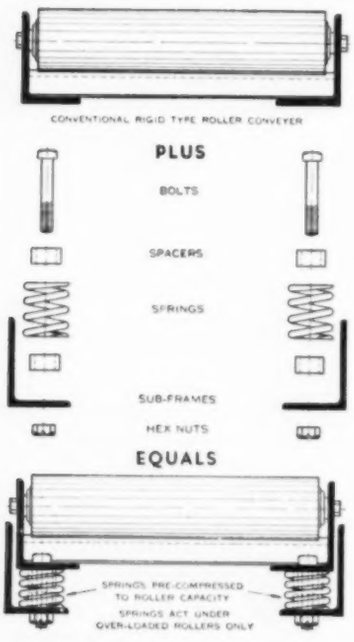
Course Is Comprehensive

It can be seen from this outline that the course as planned is quite comprehensive. Classroom work is intended to give practical instruction in the physical, chemical, and metallurgical theory underlying many of the routine operations and happenings. The shop work is not designed to produce finished craftsmen, but rather is planned to fulfill a three-fold purpose. First, to enable laborers and employes of other departments to become sufficiently familiar with the fundamental operations of either coremaking or molding so that they will be given preference in those departments when vacancies occur or when the need arises for more men.

Second, to afford an opportunity to those who are engaged in either coremaking or molding to become familiar with the more complicated and advanced phases of their work. Third, to provide a means of imparting practical instruction to those individuals who do not intend to follow the elected course as a livelihood, but whose daily work can be made more interesting and can be performed more efficiently through the knowledge obtained from the shop classes. Such individuals would be office personnel, production clerks, timekeepers, molders who have no coremaking experience, coremakers without molding experience, and pattern department per-

MATHEWS SPRING MOUNTED CONVEYERS





SPRING MOUNTED CONVEYER

CUT MAINTENANCE COSTS

THE principle is simple; the roller axles are rigidly locked in the frame as in the conventional "rigid type" construction, but the conveyer frame which retains the rollers is carried on pre-compressed coil springs. The springs are held in compression equal to the rated safe load of each roller. Under impact conditions or excessive loads the springs absorb the overload.

This construction represents the greatest improvement in roller conveyer in many years. Its application will reduce maintenance costs by prolonging the life of the equipment. When conditions are severe, "spring mounted" is the practical conveyer construction for the job.

Capacities from 150 lbs. to 8000 lbs. per roller available.

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104 TENTH STREET, ELLWOOD CITY, PENNA.

CONTINUOUS FLOW PRINCIPLE OF HANDLING MATERIALS

sonnel.

The training course at the Hamilton foundry was started officially in October, 1940. Enrollment was voluntary and was open to all employes. Registration for the class room course was closed after the second meeting. Enrollment in the shop classes is permitted at all times. All who are enrolled are required to take the class room work, but all are not required to take the shop work. Those men who in the judgment of the educational committee have had sufficient experience, are given credit for the shop work.

Each instructor has a detailed outline of the work to be covered. He keeps a record of the phase of work completed by each individual, grades him for the ability he displays, and maintains an attendance sheet.

In the shop work, some of the molds are poured and the castings examined and criticized by the instructor with the student. All work performed, whether it be molds, cores, or castings, is destroyed after it has served its purpose.

When the course was started, one out of every four employes of the plant enrolled. At the end of 3½ months, the classroom enrollment has decreased 17 per cent of the original enrollment, and the shop classes have decreased 22 per cent of the original enrollment. Over this period the attendance at the class sessions has been 89 per cent of enrollment and at the shop classes 81 per cent of enrollment. Some of the absences are due to illness and to men required because of defense production on their regular jobs on overtime basis so not free for the classes.

The training course at Hamilton is directed by an education committee which is made up of the vice president, the plant superintendent, the state supervisor and the superintendent of schools of the Hamilton City School Systems, and the instructors.

Defense Bonds

United States Treasury department has issued a 16-page booklet entitled, "Defense Savings Bonds and Stamps—What they are and the part they play in the Defense Program." The booklet gives reasons for issuing bonds and stamps and the results which it is hoped to accomplish.

Foundry Equipment Co., 1831 Columbus road, Cleveland, is building a steel fabricating shop addition of 2600 square feet to cost about $10,000. Charles A. Barnett is president.

Book Review

Pyrometery, by William P. Wood and James M. Cork, cloth, 263 pages, 6 x 9 inches, published by McGraw-Hill Book Co., New York, and available for $3.00.

This volume is the second edition of a work previously published in 1927. While there has been little fundamental change in the basic principles underlying the operation of heat measuring devices, advances have been made in production and measurement of extremely low temperatures. Also with the increasing use of pyrometric equipment in industrial control, there has been an improvement in design of such equipment to attain greater reliability and accuracy.

To meet those changes the authors have made the necessary revisions to bring the information up-to-date. Newer designs of equipment are included without eliminating data on older equipment which still is being used. The book is divided into nine chapters with an appendix containing useful tables. Various heading include temperature scales, fluid thermometers, thermoelectric pyrometers, resistance thermometers, etc.

GROUP WASH FIXTURES SAVE SPACE

★ SAVE INSTALLATION TIME . . . PROVIDE MAXIMUM SANITATION

● There has never been a time when the washing facilities for employees were being given as much consideration as they are now. Nor is there a country in the world that provides as modern, sanitary wash fixtures as are found in the plants of the U.S.A.

These fixtures, Bradley Washfountains, each accommodate 8 to 10 persons simultaneously with clean, running water from the central spray-head. Compared to individual wash basins for the same number of persons, the number of piping connections is reduced by 80 to 90 per cent, saving installation and maintenance expense.

Washroom Plan Booklet

To assist in modernizing washrooms—or planning washrooms for new buildings, Bradley Washroom Consultants are ready to make suggestions—and a copy of our booklet "Washroom Layouts" will be forwarded on request. BRADLEY WASHFOUNTAIN CO., 2217 W. Michigan Street, Milwaukee, Wisconsin.

BRADLEY WASHFOUNTAINS

Bradley Washfountains in locker-shower room in new Foundry Employees' Service Building, Caterpillar Tractor Co., Peoria, Ill. Designed by Richard Belsterling and built by Fred Harbers' Sons, Contractor.

MAKING NONFERROUS TEST BARS

(*Continued from page 53*)

by the joint effort of manufacturers and consumers whose viewpoints of course may be divergent or in some instances even antagonistic. The resulting specifications include the best that each could offer in order to safeguard the product and insure the acceptance when they would be produced under these specifications of only the most favorable product.

In many instances these specifications have resulted from the joint efforts of committees from the American Society of Testing Materials in co-operation with committees of engineering societies, such as the American Railway Engineers Association, the Federal Specifications Board and the like.

The American Society of Testing Materials specifications have been the model in many instances from which other specifications, such as the Federal specifications, have grown. However, the specifications now operative by the government for cast nonferrous metals have been developed under the joint sponsorship of the Federal Specifications Board and an advisory committee to the Bureau of Standards. The members of this committee were made up of both manufacturers and consumers of nonferrous castings so that no single viewpoint was over emphasized.

We believe the resulting specifications are sound and so workable that manufacturers of defense work will have little or no difficulty since many manufacturers of castings for commercial purposes had to divert their productive efforts from a standard commercial product to a special defense product. Use of Federal specifications and those prepared by others is a subject in which they must find much interest at this time.

The Federal Specifications for cast copper-base alloys are as follow: QQ-M-151a, "General Instructions for Inspection of Metals and Metal Castings"; QQ-B-621, "Brass Commercial and Naval Castings"; QQ-M-161, "Metal Anti-friction: Castings and Ingots"; QQ-B-691, "Bronze Castings"; QQ-B-701, "Bronze Ingots"; QQ-B-726a, "Bronze Manganese Castings"; QQ-B-731a, "Bronze Manganese Ingots"; QQ-B-671, "Bronze Aluminum Castings"; QQ-B-601, "Brass Castings (to be brazed)"; QQ-C-551, "Copper-Nickel alloy castings"; and QQ-C-593," Copper-Silicon alloy castings."

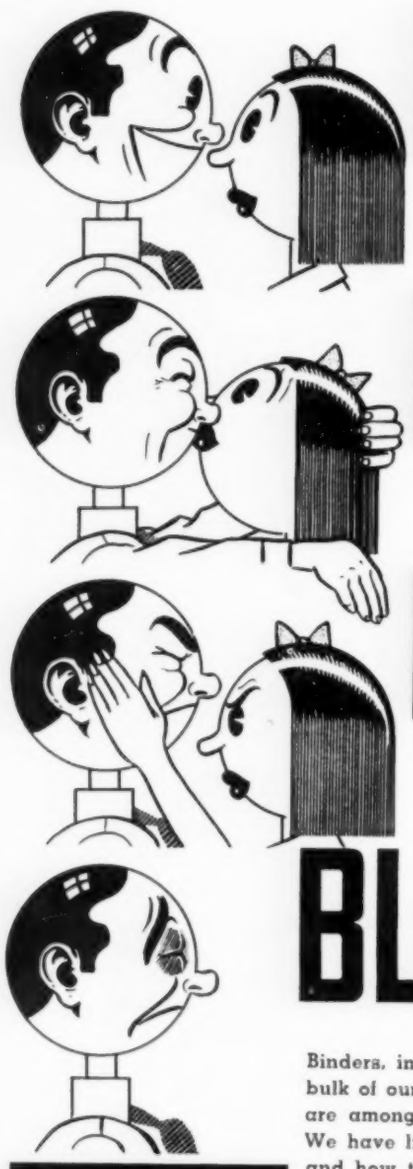
Cites Master Specification

Referring to QQ-M-151a it should be noted that this is a master specification dealing with the general rules applying to the use of Federal specifications and the operation of inspection under these specifications.

With reference to QQ-B-671 for aluminum bronze castings, that specification is in the process of revision. A specification for this same aluminum bronze series of alloys also is being revised by the American Society for Testing Materials thereby bringing these two specifications right up to date because of the recent developments in the production of this series of alloys and also because of the fact that some of these alloys respond to heat treatment resulting in a variation in the physical properties.

It should be noted also that the list does not include the specifications for aluminum bronze ingots. That is because the whole question of aluminum bronze is under consideration. Obviously ingot specifications are influenced by the castings specifications, and until the castings specifications have been cleared up the ingot specifications will not be up to date.

A recent notice from the Federal Government dated June 16, 1941 but just now made available, authorizes



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Binders, insulators and core compounds represent the bulk of our business, so we see to it that our products are among the select in a highly competitive market. We have literature describing the use of our products, and how they figure in the production of better castings and the reduction of expense. A post card will fetch a ready answer.

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PITTSBURGH, PENNA.

substitution for QQ-B-621 of materials covered by QQ-B-601 in accordance with the following paragraph which we quote from the official instructions:

"Brass castings in accordance with Federal Specifications QQ-B-601 should be used only where strength is relatively unimportant Since this alloy contains a strategic material, although in smaller percentage than materials covered by specifications QQ-B-621, it should be used only where other alternate materials are unsuitable."

"Government purchasing agencies should make every effort to use the alternate materials for purposes other than those for which the material covered by Federal Specification QQ-B-621 is indispensable. In addition to the alternate materials covered by the specifications listed in paragraph A, it is suggested that consideration be given to other casting alloys and other materials which may be processed by other methods of fabrication to form a suitable article or part. Purchasing agencies are cautioned to refer any questions with regard to the suitability of alternate materials to the appropriate design agency for consideration and authorization."

Revised Specification Available

The material covered by QQ-B-621 is for commercial and naval brass castings. This specification was revised February, 1934, to the extent that certain paragraphs were slightly changed in the order in which the paragraphs were to appear in the specification. In the interest of those asking for copies of this specification it would be well to ask for the page covering the revision as well in order to have the specification complete. All of these specifications are available at the U. S. Government Printing Office, Superintendent of Documents, Washington, for 5 cents each.

As mentioned previously, the specifications are not intended to be descriptive of any given alloy insofar as illustrating the average physical characteristics to be expected in well made castings. Therefore, those who use them as such are basing their calculations on rejection limits instead of truly average figures that necesarily should be used. Foundrymen should remember that where the specification limits certain impurities, those limits have been established because the presence of these impurities in larger quantities than so listed is detrimental to the quality of the product and may result in castings that are outside the rejection limits.

Furthermore, presence of elements other than those permitted by the specification may cause rejection even though they may not be necessarily detrimental. However, they do present opportunity for argument with inspectors and may result in delay that will be expensive because of these arguments. The specifications do not outline the methods of production or methods of manufacture but in the articles appearing in previous issues we discussed many phases of the melting practice of these cast nonferrous metals that may cause trouble or even cause rejection when these precautions are not observed.

We also have outlined the subject of gating. Of course, the shape, size and mass of the wide variety of castings produced cannot be discussed in detail because designs change so frequently and are of such wide variety. However, good melting practice plus careful molding and coremaking with the use of metals that are definitely within the limits specified in the specifications, will result in a very high class product that will pass inspection without much difficulty. Obviously if the details of the specification are observed carefully and any difficulty that can be anticipated from reading the specification should be thoroughly understood before attempting to make castings to meet the specifications.

We believe the average experienced foundryman will have little

IT IS quite possible that there is a standard Lanly Oven that will fit exactly into your production program.

With all engineering problems "licked" and the oven thoroughly tested in service and proved to be highly efficient, you'll be assured of large production of well baked cores.

Heat is produced by the Lanly Convection Heater (a modern example of engineering efficiency) circulated uniformly throughout the oven to thoroughly bake the cores, regardless of their position in the oven, and recirculated to assure the utmost fuel economy.

Lanly standard ovens, with their well-insulated metal panels and doors, may be erected quickly and as easily dismantled for moving and re-erection, if desired.

Get a proposal from Lanly.

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CORE OVENS
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difficulty in having his product accepted under these standard specifications if he will observe due care in the production of the metal and due diligence in preparing a first class mold in which is located the necessary test bars properly designed to conform with those indicated on the Federal Specifications for that alloy and gated in accordance with suggestions in the articles appearing in the August and September issues.

Where the foundryman is called upon to make castings from some of the compositions not specified by the Federal Specifications Board but covered by others, such as the American Society for Testing Materials, or special specifications prepared by others, such as the General Motors Corp. which has a set of standard specifications of its own, the use of a similar type of test bar to those called for by the Federal Specifications will be found advisable. In previous articles we have discussed the fact that there are three general types of these standard bars. One, the bar in which the riser is located over the entire length of the bar connected with a cast to shape bar by a thin web. This bar should be used for red brasses and the phosphor bronzes and then the other two bars are the ones with large shrink heads such as the keel block for use when casting high shrinkage alloys such as aluminum bronze.

Open Branch Office

To permit closer co-operation with the National Defense Administration, and to expedite transmission of information to its members, the Gray Iron Founders' Society has opened a branch office at 1622 H street, Washington. W. W. Rose, executive vice president of the society will be in charge.

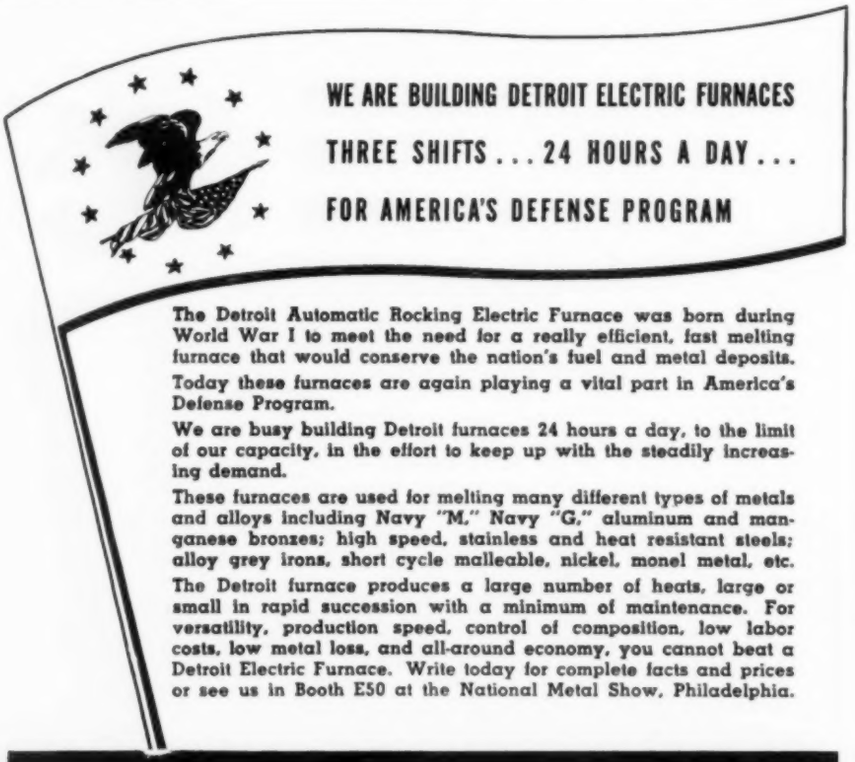
Plastic Molding

Bakelite Corp., New York, just has published the fourth edition of "Molding Technic for Bakelite and Vinylite Plastics." It contains 226 pages comprising technical data on molding practices for both hot-set and cold-set molding plastics. It is divided into 14 chapters covering such phases as principles of molding; proper mold and product design; molding plant layout, etc. While previous editions were limited in distribution, the new edition is for general sale and may be obtained for $3.50 a copy.

Issues Booklet

The Home Craftsman Publishing Corp., 115 Worth street, New York, recently has published a 64-page booklet entitled, "How to Fit Yourself for Defense Jobs," which was edited by Harry J. Hobbs and data compiled by Stephen A. Hoffer, William B. O'Connor and Guy G. Woods. The discussion is divided into the following headings: Jobs with a future; selecting your job; eleven industries where job opportunities are greatest; three hundred best defense jobs; where to go for training; where to go for a defense job; what to expect when you apply for a job; sample test for machine shop workers; best books for home study; and tips from employers. Copies may be obtained for 25 cents each.

National Bureau of Standards, Department of Commerce, has reprinted simplified practice recommendation R58-36, classification of iron and steel scrap, in response to a sustained demand. The recommendation specifies classes of scrap for blast furnace basic and acid open-hearth, and electric furnaces for gray iron foundry practice, bessemer converters, and for miscellaneous scrap, and includes a contract form for the purchase of scrap. Copies may be obtained from the Superintendent of Documents, Washington, D. C. at 5 cents per copy.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We are busy building Detroit furnaces 24 hours a day, to the limit of our capacity, in the effort to keep up with the steadily increasing demand.
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DETROIT ELECTRIC FURNACE DIVISION
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STEEL SAND MIXTURES

(*Continued from page* 61)

of error, the permeability machine should be checked at least once each day against a standard sample on which the permeability is already known.

Tests are not always used correctly. A high moisture test is observed and at once the mill man is criticized without first finding out if the old sand being used in the mix contains more bond or fines. If it contains more bond or fines it has more surface area and naturally more water has to be used to temper it properly. It is just as important, if not more important, to check the materials before they go into the mill than it is to check the mix after it comes from the mill. The old sand going into the mixes in a shop where a variety of cores or facings are used will vary considerably. So first the old sand should be checked and the mix varied to take care of the inconsistency in the old or reclaimed sand.

Testing Practice Varies

Some foundries do not even use their sand testing equipment, while others make tests and never pay any attention to them. In practically all cases, all or a portion of the sand is used before the sand is tested. Most foundrymen approve sand testing but it appears that there is much to be accomplished.

For an up to the minute method on checking sand mixes in the mill the author recommends a recording wattmeter or ammeter on the sand mill motor. Any variation of the mix will show a different pull on the motor and that is recorded automatically. It shows when the water is added, when the binders are added, for each in turn has an effect on the pull of the motor. It also shows how long the batch is in the mill. Such an instrument checks every batch before the sand is unloaded from the mill, which is really what is wanted.

If one batch of a specific mixture shows a greater pull on the motor than another batch, then the mill man knows something is wrong, either too much or too little sand has been used, the bond of the sand is different, or the right amount of binders has not been used. The use of such an instrument along with sand testing equipment should give good control.

Most foundries do not treat their sand testing with the same thoroughness or seriousness as they do in checking their metals. In fact, such a small amount of attention is paid that oftentimes the sand man or sand tester loses interest in his work. Many foundries use their sand laboratories for breaking in their foundry foremen. Very seldom do they take a foreman and convert him into a sand man.

Quite a few foundries pay their sand men so little and give him such little authority that if they obtain a good man he will not stay on the job. Why do you not place him on a par with the metallurgist in pay and prestige? Some foundries use their metallurgist to look after their sands, but usually the metallurgist who is schooled in metals, which are his hobby, pays little attention to the sand.

Most steel foundries are large enough and have enough scrap and cleaning costs due to sand to warrant obtaining or training a first class sand man. However, before the foundries can expect worthwhile results they will have to give the sand man authority, prestige and a salary worthy of a real job. On new patterns the sand man should be on the job to determine what sand mix should be used just the same as the foundry foreman marks the patterns for gates and risers.

The sand man should be responsible for sand and binder costs, scrap due to sand troubles, and cleaning

In addition to our regular High Speed Band Saws delivering over 2 miles of smooth vibrationless saw travel per minute, which have proved so exceedingly popular in automotive and aviation work, the TANNEWITZ line now offers five other models to provide the fastest cutting medium for every foundry need: a 30" machine to provide any speed from 300 to 900 blade feet per minute—a similar machine with 3-step V-belt drive to give 450, 600, 750 blade feet per minute—a 36" machine with 32" capacity under the guide—a model with 48" wheels and one with 52" wheels, operating at 3,000 blade feet per minute for handling extra large castings. Get a line on the TANNEWITZ metal cutting band saw that fits your particular needs. It will save time, step up production and repay its cost dozens of times. Write for full particulars NOW!

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

costs due to sand. He should have the cleaning cost due to sand to compare with his material costs for often an increase in the material cost will be more than offset by a lowering of the cleaning cost. Oftentimes the foundry will send out a casting to the cleaning room, which they know will be hard to clean, in order to save on their material cost or to hold down on their amount of new sand per ton of castings. To remedy this, the two costs should be kept side by side and one man be made responsible for both.

The fact of the matter is that many problems exist on which a good sand man would be well worth a good salary. The matter of controlling the heap sand in a miscellaneous shop is alone quite a problem due to the variety of facings used and the variation in amount of core sand in different jobs.

Another problem that should be his, is the reclamation of sands. Many shops still haul out sand to the dump even though a lot of work has been done on reclaiming with some good results. The author finds that when a foundryman wants a very nice appearing casting that has to be machined he usually uses new sand in the facing—in fact, all new sand. Of course, there is a certain class of castings which can be made with all reclaimed sand with good results, but on other castings that tend to burn-in, the tendency is to use new sand, which goes to prove that there is a lot yet to be acomplished in the reclaiming of sands. The author recently saw data obtained from foundries in which 38 facing mixes were reported. Twenty-two of them contained all new sand—15 new and old sand—and only one contained all old or reclaimed sand. As can be seen, there is a lot yet to be desired in sand reclamation.

The drying of molds and cores is another problem about which we know very little. Recently while drying some oil sand cores in dryers which contained a considerable amount of silica flour and wishing to speed the drying of the cores, the amount of silicon flour was reduced. That procedure permitted a reduction in the amount of water and oil used. To the author's surprise, the latter cores—that is, those with less silica flour, less oil and less water—did not dry out on the pan side of the core as fast as the cores made with more silica flour even though the cores were baked side by side.

Core Drying Problem

Since making this test, several other foundrymen have stated that they too have noticed that cores with silica flour seem to bake out better on the plate side of the core. The author was always of the opinion that the more open the sand the quicker the core would bake, but the previously mentioned facts seem to disprove that theory. This all goes to prove that we know very little about drying of cores and here again is a problem for the sand man to solve.

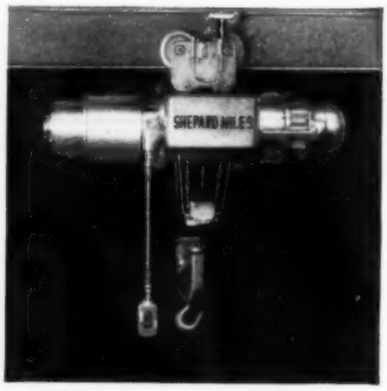
Another matter, which at first seems very radical, has developed in the last few years. It is the use of a special oil in green sand facing for manganese steel castings. We all know what will happen if a mold is poured with a green core, so the first thing we think is that it would be impossible to use an oil in the facing. The fact of the matter is that the molds pour smoothly and that this special oil reduces metal cutting, sand burning-in, and the slaggy, pitted appearance usually obtained on green sand manganese castings.

It sounds radical, but it does a real job on manganese steel. It does not seem to work so well with low carbon steel. Just why it works with one type of steel and not with another, is not known. There are theories, but none have been proved definitely. If the reason could be found, then it is highly possible that something could be developed

Shepard Niles multiple speed push button control for all 6 travel motions applied to 3-motor electric traveling crane.

SHEPARD NILES multiple speed push button control provides 5 selective speeds by one push button for each travel motion. Each button as it is pressed inward makes five electrical contacts, corresponding to five independent speeds in each direction of travel

Push button master switch cases are of aluminum alloy and made slender enough to be grasped easily with the hand. An assembly of two or three master switches in tandem can be furnished for the control of 2-motor and 3-motor cranes and hoists. An emergency stop switch is provided at the lower end of the assembly.



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Another matter, the reason for which is still not clear, is why use of oil in dry sand facing tends to prevent waviness in steel castings, tends to give sharper corners, and more distinct lettering. The practice is used very generally, but no one seems to know the reason.

Sintering and fusion points on sands are another matter about which very little is known. True, we are able to establish the fusion and sintering points, but when it comes to saying that they have a definite relationship with sand burning-in, it is not always the case even with sands of the same grain size.

This article is from a paper presented by the author at a meeting of the operating group, Steel Founders' Society of America recently held at Pittsburgh.

Foundry Equipment Rates Priority

To assist manufacturers of foundry equipment and repair parts in obtaining certain scarce materials essential to their operations, Donald M. Nelson, Director of Priorities, on Sept. 6 issued a limited blanket rating order assigning the high defense ratings of A-1-b and A-1-c to the acquisition of six listed items.

The six items are castings and forgings; sheets, bars, shapes, plates and tubing (ferrous, nonferrous and non-metallic); electrical equipment and accessories; mechanical equipment and accessories; cutting tools, including cemented carbides; and maintenance and shop supplies (restricted to items necessary for proper operation and maintenance of manufacturing equipment and facilities).

The A-1-b rating is assigned to deliveries of these materials to makers of molding and core machines; blast cleaning equipment; dust arrestors; sand preparing and handling equipment; and briquetting equipment.

Manufacturers producing melting furnaces, blowers, ladles, tumbling mills, shakeout equipment, and mold and core ovens, are granted the assistance of the A-1-c rating in securing the listed materials.

These ratings may be extended as far as is necessary to assure ultimate delivery of the required materials to the manufacturer.

A manufacturer receiving the assistance of these priority ratings may fill only defense orders for the products thus expedited, or such other orders as the Director of Priorities may direct him to meet.

William Demmler & Bros., Kewanee, Ill., manufacturer of core blowing machines, is enlarging its plant.

Safety Congress To Be Held in Chicago

The thirtieth annual National Safety Congress and Exhibition sponsored by the National Safety Council, Chicago, will be held in Chicago on Oct. 6 to 10. Headquarters will be at the Stevens hotel. Of particular interest to foundrymen will be the metals section meetings. On Tuesday afternoon Oct. 7 a panel discussion on various foundry safety topics will be held with H. S. Simpson, Caterpillar Tractor Co., Peoria, Ill., presiding. Participants will include M. W. Dundore, Beloit Iron Works, Beloit, Wis.; J. W. Fehnel, Metropolitan Life Insurance Co., New York; E. O. Jones, Belle City Malleable Iron Co., and H. H. White, Pittsburgh Rolls division, Blaw-Knox Co., Pittsburgh.

Approximately 10,000 people attended the second annual picnic held by employes of the Gisholt Machine Co., Madison, Wis., on Aug. 17. A soft ball game started the program at 10:30 a. m., followed by a lunch. In the afternoon entertainment was provided after which George H. Johnson, president of the firm, addressed the employes and guests.

ROSS CORE DRAWER

Makes Cores True to Size

Draw your cores as you draw your patterns with the aid of vibrators. Eliminates rapping expensive core box equipment. Designed for Jobbing or Production.

Use present equipment—either wood or metal boxes, and make better cores faster. No special rigging required.

Send for Full Descriptive Pamphlet

THE FREEMAN SUPPLY CO.

Pattern Shop and Foundry Supplies and Equipment
Mahogany and Pine Pattern Lumber

1152 EAST BROADWAY **TOLEDO, OHIO**

ORNAMENT BOULDER DAM

(*Continued from page 63*)

years ago the great wise king, lute in hand, sat on his ivory, gold and peacock throne and lifted up his voice in song. Two excerpts indicate that he was in excellent form: "For lo the winter is past; the rain is over and gone; the flowers appear on the earth; the time of the singing of birds is come; and the voice of the turtle dove is heard in the land. The fig tree ripeneth her green figs and the vines are in blossom. They give forth their fragrance." Song of Solomon II, 11-13.

"A garden shut up is my sister, my bride. A spring shut up, a fountain sealed. Thy shoots are an orchard of pomegranates with precious fruits; henna with spikenard plants; spikenard and saffron; calamus and cinnamon with all trees of frankincense; myrrh and aloes, with all the chief spices. Thou art a fountain of gardens, a well of living waters and the flowing streams from Lebanon." Song of Solomon IV, 12-15.

Only the people familiar with deserts and semi arid lands truly appreciate the value of pure, sparkling running water.

Even an amateur interpreter of the Song of Solomon should have no difficulty in proving: (a)—That he had California in mind. Fig trees and semi tropical fruits. Flowing streams from Lebanon correspond to streams that have their origin in the high Sierras. (b)—That the singer was an enthusiastic admirer of water—not necessarily as a beverage and (c)—That he had in mind the day when water would be available everywhere. In a word he predicted the erection of Boulder dam.

A possible reason for the neglect of the press agents in utilizing Boulder dam to build up an unknown or potential star in the entertainment field is that press agents are familiar only with water as something necessary in ornate swimming pools, or in the bath tubs where apparently their proteges spend most of their spare time presumably reading the funnies. With the foregoing shrubbery chopped away from the real trees, brief reference may be made to the dam and to the magnificent bronze figures which face the Black Gorge of the Colorado and which bid fair to sit there in silent majesty so long as grass grows or water runs, or until the rivers cease to flow down to the sea. In other words, tourists need not hurry. The figures will be there next summer.

Great Engineering Feat

Construction of the dam, part of a gigantic scheme conceived and carried out by the bureau of reclamation, United States Department of the Interior, represented one of the greatest engineering feats ever attempted. What was claimed at the time to be the greatest industrial undertaking of the United States government since the Atlantic and Pacific oceans were linked by the Panama canal, was completed in the Black Canyon of the Colorado about 25 miles southeast from Las Vegas, Nev. At this point the erratic river makes a definite turn and flows almost due south to its ultimate destination in the Gulf of California. After a wild and tortuous flight of nearly 1000 miles through a slash in the earth's surface, in places torn away to a depth of thousands of feet in the solid rock, the dark red, turbid, turbulent waters of this great western river "Too thick to drink and too thin to plow" are subdued and harnessed a short distance below the turn by the solid concrete structure known as Boulder dam.

At flood periods when the snow is melting on the mountains, a volume of silt laden, foaming water estimated at 300,000 cubic feet per

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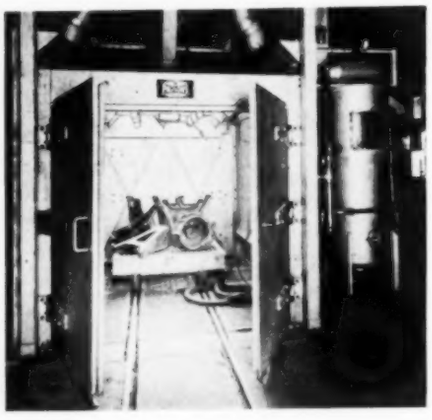

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second rushes through the lower gorges which separate Arizona from Nevada. So far as human skill, experience and knowledge can determine, nothing short of a general upheaval of the earth's surface in the vicinity will loose the dam from its anchorage. With foundations extending 150 feet into the solid rock at the bottom of the river and with the ends of the walls anchored solidly in mortises in the rock walls of the canyon on either side, the dam forms an integral part of the canyon itself. Apparently it is there to stay. The dam is 750 feet high, 650 feet wide at the bottom and 45 feet wide at the top where it is 1180 feet in length.

The resulting lake of water extends 115 miles upstream and in places is 8 miles wide with a capacity equal to the anticipated volume of water carried down by the river in a 2-year period. This includes a deposit of 200,000 acre feet of silt, which—if undisturbed—will completely fill the space behind the dam in exactly 222 years.

Purpose of Dam

Boulder dam was designed primarily as part of a general reclamation system in which the object is to control and manipulate any given source of water supply for irrigation purposes. Instead of submitting to alternate periods of flood and drouth, the flood waters are impounded and held in storage to be released in regulated volume throughout the year including the normally drouthy periods. The lake serves as a settling basin for the silt. In addition to its value as an irrigating medium the dam serves as a source of hydroelectric power for a large area of the Southwest. Before the electric current generated at Boulder dam can reach centers of population in southern California it has to be carried 230 miles through a great waste country to a crossing of the San Bernardino mountains near Cajon pass, gateway from the desert to the vast garden country to the west.

Transcontinental American travelers, airplane, train, bus, limousine, family car, trailer, jallopy, or plain thumbers and hitch hikers crossing the great, wide, desolate combination of mountain and desert extending from the Canadian border to Old Mexico, invariably decide that this section of the country never will be inhabited by human beings. Readers of Longfellow's *Evangeline* will remember a passage from the section describing the western part of the heroine's heart breaking search for Gabriel: "Far in the West there lies a desert land where the mountains lift through perpetual snows, their lofty and luminous summits. Down from their jagged, deep ravines where the gorge, like a gateway opens a passage rude to the wheels of the emigrant's wagon, westward the Oregon flows and the Walleway and the Owyhee. Eastward with devious course among the Wind river mountains, through the Sweetwater valley precipitate leaps the Nebraska; and to the North from Fontainequi-bout and the Spanish Sierras, fretted with sand and rocks and swept by the winds of the desert, numberless torrents with ceaseless sound descend to the ocean, like the great chords of a harp in loud and solemn vibrations. Over them wander the scattered tribes of Ishmael's children; staining the desert with blood. And above their terrible war trails, circles and sails aloft, on pinions majestic, the vulture like the implacable soul of a chieftain slaughtered in battle, by invisible stairs ascending and scaling the heavens. Here and there rise smokes from the camp of these savage marauders."

The author develops the theme to quite an extent, but the foregoing passage conveys a general impression of this arid land. The savage marauders, battle, murder and sudden death boys who stained the desert with blood, actual and realistic at the period to which the poem refers, happily long since have been translated to the happy

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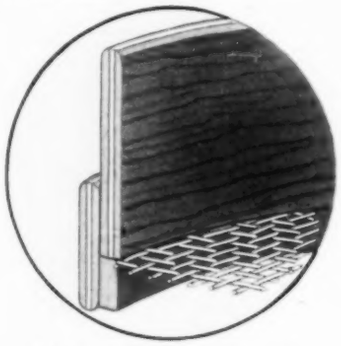

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The accompanying illustrations indicate the size and some of the interesting features of the bronze ornamental figures erected on Boulder dam. Fig. 6 shows the plaster model or pattern as it appeared in the sculptor's studio. The part shown here is about 16 feet high. The upright and extended wings prepared separately, add 14 feet, or a total height of 30 feet for the complete figure. Realization of the great height may be inferred from Fig. 3 where two small visitors gaze upward at the figures with proper awe and respect, or at least with a reasonable facsimile of these emotions on their cute little cherubic faces. Sixty years from now they brazenly will tell their grandchildren that these figures were at least 300 feet high. The figures about 40 feet apart are placed on a polished semicircular granite base with the flag pole in the center. They face down stream and across the 1000-foot gorge of the river.

Is Principal Decoration

Fig. 2 is one of two identical figures of the Republic, designed by Oskar J. W. Hansen, Chicago, and installed as the principal decoration on Boulder dam. Each bronze figure is 30 feet high and weighs 4 tons. Fig. 1 shows a night view of the winged figures with the Nevada intake towers in the background. The sketch, Fig. 4 shows where the pattern was parted to facilitate work in the foundry. The first parting at *A* included the upper part of each wing. The second parting at *B* separated the lower part of the wing from the torso. The third parting line at *C* separated the torso from the lower part of the body, the legs and feet.

At each joint line the section was provided with a Roman joint as shown in exaggerated form in Fig. 5. Some dead and forgotten genius developed this simple and highly ingenious type of joint for bronze figures probably 2000 years ago. Like many other shop kinks it was so perfectly perfect that it has been used ever since, even down to the present. In recent years welding equipment has facilitated the work, but the basic principle still is the same as that employed by the highly skilled Roman artificers.

The edges of two adjoining pieces are recessed as shown to form a male and female joint. Projecting ridge on the upper part is on the outside, while the corresponding ridge on the lower part is on the inside. The parting line may be straight or may be highly irregular to follow a fold in the garment or

■

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other feature of the figure. The outer edge on both parts along the joint line is increased to form a projecting ridge of extra metal. The two parts are fitted together and held in place by a number of rivets with countersunk heads. The projecting ridge then is hammered down flat or until the opening between the two parts is completely filled. Excess metal is chipped away and the surface is filed until all traces of the joint disappears.

In some instances flanges are provided near the joint on the inside. A number of holes are drilled in these flanges and the parts are joined by bolts. In other instances the figure may be built around a steel frame to which it is bolted in the same manner. The figures shown in the illustrations are self supporting. The parts were fitted and riveted and then each joint was arc welded. The joints and all outer parts of each figure were hand chased by skilled operators. Up to the highest joint marked on Fig. 6, the metal thickness was ½-inch. From this point to the upper tip of the wing the metal thickness was approximately ⅜-inch. Total weight as noted elsewhere, 4 tons.

Used French Sand

Molds and cores were made in French sand. This sand from a deposit near Paris possesses certain characteristics which render it particularly suitable for work of this kind. So far as known no other sand in the world equals it in this respect. It is refractory and fine grained carries a natural bond, can be rammed hard, dries in the air like an adobe brick, has a high permeability and has no combustible content. It is perfectly inert, the ideal material for metal to lie against quietly.

Plaster patterns, full size enlargements of the original clay models, were used as patterns. A brief description of the molding methods practiced on one will serve for all. The methods differ to a considerable extent from those practiced in the ordinary foundry. Through a long and arduous training period the molders develop a high degree of skill and manual dexterity. The cope flask is laid on its back on the floor and filled with sand. A hollow is scooped in the sand and the pattern is bedded into approximately the correct position. Sand is tucked under and around the edge and a rough temporary parting is made. The drag then is rammed and the assembly is rolled over. The false cope is removed, a proper parting is made, the cope is replaced, rammed full of sand and lifted off. The pattern is removed from the drag and then the special skill of the molder is brought into play.

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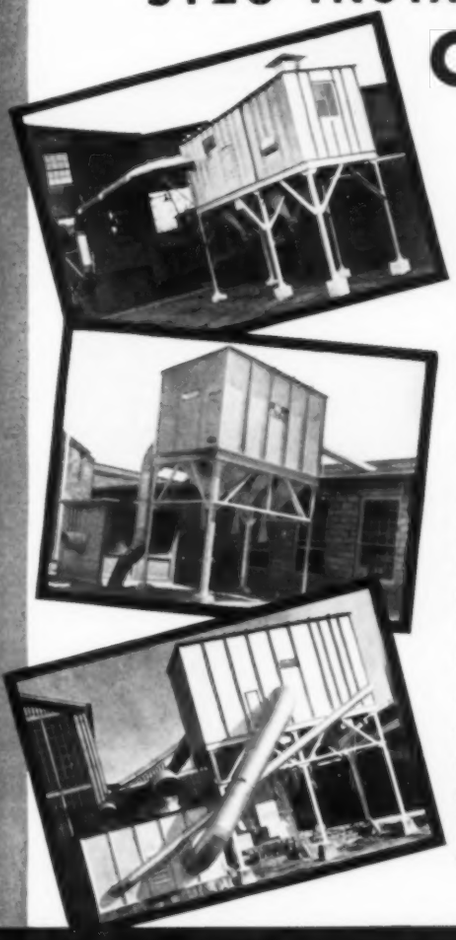

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Out of a miscellaneous collection of steel rods and pipes he has to construct a skeleton arbor to support the core. The arbor is fitted directly in the mold which then becomes a corebox and is rammed full of sand. A number of the arbor rods project in to the drag where they will serve later as anchors to hold the core in place. The cope is replaced on the drag and sand is rammed in through an opening or openings to complete the core. The entire assembly then is rolled over and the drag is lifted off to expose the core.

Thumb tacks are inserted a few inches apart all over the exposed core surface. The tack heads are flush with the sand and serve as guides while the molder with suitable tools removes a thickness of sand corresponding to the desired thickness of metal in the casting. The drag then is replaced, the entire assembly rolled over for the last time and the cope is removed until the molder has cut away a thickness of sand similar to that on the bottom. The mold and core are placed in the oven and dried. Then removed, set up on the floor, bolted or clamped and the runner basin is made up. Usually the basin is dried and is large enough to hold all the metal required in the casting. A plug in the sprue is removed when the basin is filled.

Undercuts or back drafted areas on the pattern are packed full of sand and provided with small hooks. These cores or draw backs are removed separately after the cope or drag are removed from the pattern. They are attached in proper position on cope or drag face by wires fastened to the hooks. The entire procedure involves the highest degree of individual skill, experience and knowledge and represents probably the choicest blossom on the molder's tree of achievement.

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Cutler-Hammer Inc., Milwaukee, has established a warehouse at 131 Clarendon street, Boston, Mass. The company's Boston sales office has been moved to new and larger quarters adjoining the warehouse. W. E. Addicks is district manager in charge of the Boston territory.

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MAKING ALLOY ADDITIONS

(*Continued from page* 66)

tests were conducted according to A.S.T.M. standards, using 18 inches between the centers of the supports. The maximum load sustained and the deflection at the maximum load were recorded in each case. A standard B-type (A.S.T.M. A48-36) tension test specimen was machined from the lower half of each transverse test bar. This was tested to destruction in the hydraulic tension testing machine. Another section of the transverse test bar, 4 inches long, was annealed at 1400 degrees Fahr. A tension test specimen was machined from this sample and tested. The chemical analyses of the first and last sets of test bars cast from the heat were determined. These analyses were in such excellent agreement it was considered unnecessary to analyze the other bars.

The duplicate test bar of each composition was cut into seven 2-inch lengths. One of these sections from each composition was placed in a furnace at 1000 degrees Fahr. and held there for one hour, after which time the power to the furnace was disconnected and the furnace and contents were cooled to room temperature. This procedure was repeated, using temperatures of 1100, 1200, 1300, 1400, 1500 and 1600 degrees Fahr. The samples were then surface ground in a manner to produce rectangular surfaces ¾-inch wide on the cylindrical surfaces of the samples. Two brinell hardness determinations were made on each sample on this surface. The average of the two determinations was taken as the hardness of the sample. The average values have been plotted on graph paper and are shown in Figs. 4 and 7.

From the charts the annealing temperature required to produce a hardness of 207-217 in each iron was ascertained. Four-inch lengths of the bars were prepared and annealed at the designated temperature. Tension test specimens were machined and tested. The results of these tests are given in Table I.

Slight variations in the hardness data given in Table I and those given on the charts, Figs. 4 and 7, for as-cast and annealed at 1400 degrees Fahr. are due to slight variations in the bars themselves and to the fact that hardnesses used in the charts were made close to the surface of the cast test bar, while the hardnesses used for Table I were determined upon a plane surface produced by grinding the

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threaded shoulders of the tensile specimens.

For the sake of convenience, values of the bars as-cast and annealed at 1400 degrees Fahr. have been tabulated in the order of decreasing strength and decreasing Brinell hardness, respectively. The data for tensile strengths of the compositions after annealing to a common brinell hardness of 207 to 217 have been tabulated in the order of decreasing tensile strength.

Metallographic specimens were prepared from the as-cast tension test specimens and from specimens annealed at 1400 degrees Fahr. Photomicrographs were made to illustrate representative structures of the various compositions in these two conditions as shown in Figs. 1, 2, 3, 5 and 6, and others which will appear later.

All irons showed some tendency toward the dendritic and eutectiform types of graphite distribution. A study of the microstructures of the irons failed to reveal any definite effects of the alloy additions upon the size, shape or distribution of the graphite flakes. After observing the unetched microstructures of these irons, it was believed that the graphite flake size and distribution were sufficiently alike in the 14 irons to make the alloy additions almost wholly responsible for the differences in mechanical properties.

It is difficult to produce a photomicrograph which will accurately represent the complete cross section of a B-test bar since the microstructures vary from location to location. However, an attempt was made to locate an area in one sample which contained the various arrangements of graphite flakes found in the cross sections of the tensile bars and which also represented approximately the proportion of each one of these arrangements found. Fig. 1 illustrates this representative structure.

The effects of the alloy additions upon the microstructure of the base iron are shown in the photomicrographs of the as-cast irons at 1000 diameters. The major effect of the additional alloying element, or elements, has been to lower the temperature of austenite decomposition upon cooling, thereby producing pearlite with finer lamellae and of greater hardness. It has been shown[1] that pearlite produced by the austenite of eutectoid carbon steel transforming at 1300 degrees Fahr. will have a brinell hardness of 201 and coarse lamellae, whereas when the austenite of the same steel transforms at 1150 degrees Fahr. the lamellae are finer and the hardness will have been raised to 352.

Three of the irons contained some traces of martensite. These were the nickel-molybdenum iron, No. 7, (Fig. 2); the copper-molybdenum iron, No. 9, (Fig. 3); and the chromium-nickel-molybdenum iron, No. 12, (Fig. 5). The temperature at which austenite transforms on cooling depends upon two factors: 1) the transformation rates of austenite at different temperature levels, and 2) the cooling rate. The cooling rate for each test bar was the same since all the molds were alike and the pouring temperature was held constant.

Alloying elements exert a profound influence upon the transformation rates of austenite.[2, 3, 4] All of the elements used in this investigation are known to stabilize austenite or reduce the rates of transformation, forcing the austenite to transform at lower subcritical temperatures upon cooling at a constant rate. The effects of these alloying elements upon the transformation rates of the austenite depend upon the potency of the element itself, the quantity present, and the rather unexpected behavior of combinations of alloying elements. In this manner the additions used in this investigation exerted their influences upon the transformation characteristics of austenite in such ways that the austenite was forced to transform between different temperature levels producing pearlite of various degrees of fineness, hardness and tensile properties.

Table II

Decreasing Strength—As Cast

Tensile Strength		Alloy Addition to Base				
p.s.i.	BHN	Cr %	Mo %	Cu %	Ni %	V %
55,500	285	0.49	0.43	....	1.45	....
52,400	269	....	0.54	0.65	....	....
50,600	248	0.47	0.43	0.52	....	....
50,000	269	....	0.54	....	0.66	....
48,400	255	....	0.47	....	....	0.13
46,200	262	0.61	0.56	....	....	....
45,400	255	0.49	....	....	1.45	....
44,000	241	....	0.47	....	....	....
43,500	235	....	....	1.80	....	....
43,000	241	0.50	....	0.52	....	....
41,700	241	0.56	....	....	....	....
41,700	235	....	....	....	1.72	....
41,000	229	....	....	....	....	0.12
37,400	217	Plain				

Table III

Decreasing BHN After Annealing

BHN	Tensile Strength p.s.i.	Alloy Addition to Base Cr %	Mo %	Cu %	Ni %	V %
217	44,500	0.61	0.56	....	....	....
207	43,100	0.47	0.43	0.52	....	....
207	40,000	0.56	....	....	....	....
201	38,200	0.50	....	0.52	....	....
197	42,600	0.49	0.43	....	1.45	....
187	37,400	....	0.54	0.65	....	....
179	40,000	....	0.47	....	....	0.13
156	34,800	0.49	....	....	1.45	....
156	33,000	....	0.54	....	0.66	....
156	31,200	....	....	....	....	0.12
149	29,900	....	....	....	1.72	....
146	31,600	....	0.47	....	....	....
143	29,900	....	....	1.80	....	....
143	27,700	Plain				

Table IV

Decreasing Strength at BHN 207-217

Tensile Strength p.s.i.	BHN	Alloy Addition to Base Cr %	Mo %	Cu %	Ni %	V %
47,000	217	....	0.47	....	....	0.13
46,200	217	0.61	0.56	....	....	....
45,400	212	0.49	0.43	....	1.45	....
44,000	217	....	0.54	0.65	....	....
43,600	217	0.47	0.43	0.52	....	....
43,500	207	0.49	....	....	1.45	....
43,000	217	....	0.47	....	....	....
42,600	212	....	0.54	....	0.66	....
41,800	217	0.50	....	0.52	....	....
41,800	217	....	....	1.80	....	....
41,300	212	0.56	....	....	....	....
41,000	217	....	....	....	....	0.12
38,200	212	....	....	....	1.72	....
37,800	217	Plain				

Table V

Effect of Molybdenum Additions

No.	Type	As Cast BHN	As Cast Tensile Strength p.s.i.	Annealed at 1400° F. BHN	Annealed at 1400° F. Tensile Strength p.s.i.
(1)	Plain Iron...	217	37,400	143	27,700
(4)	Mo Iron.....	241	44,000	146	31,600
(2)	Cr Iron.....	241	41,700	207	40,000
(8)	Cr-Mo Iron..	262	46,200	217	44,500
(5)	V Iron	229	41,000	156	31,200
(10)	Mo-V Iron ..	255	48,400	179	40,000
(11)	Cr-Ni Iron...	255	45,400	156	34,800
(12)	Cr-Ni-Mo Iron	285	55,500	197	42,600
(13)	Cr-Cu Iron..	241	43,000	201	38,200
(14)	Cr-Cu-Mo Iron	248	50,600	207	43,100
(8)	Cr-Mo Iron..	262	46,200	217	44,500

Ability of molybdenum to stabilize austenite upon cooling from the casting temperature is shown clearly in Table V. Note the increase in strength and brinell hardness in the as-cast condition produced by adding approximately 0.50 per cent molybdenum to the plain iron and to other irons alloyed with various elements. The increase in strength varies from 4500 pounds per square inch in the case of the chromium iron, No. 2, to 10,100 pounds per square inch in the case of the chromium-nickel iron, No. 11. Similar tables can be produced to study the effects of other alloys.

It often has been pointed out that in making alloy additions to cast irons and steels, combinations of particular elements produce improvements in hardness and strength that would not be expected from a study of the effects of additions of the same elements alone. Table V illustrates this well, and shows how the improvement in properties imparted to the plain iron by the addition of a single element can be greatly enhanced by adding a second alloying element. The addition of 0.47 per cent molybdenum to the plain iron raised the tensile strength 6600 pounds per square inch, while the same addition to the vanadium iron increased the tensile strength 7400 pounds per square inch, and again the same addition to the chromium-nickel iron increased the tensile strength 10,100 pounds per square inch.

An analysis of the curves shown in Figs. 4 and 7 involves the following factors:

1. The stability of the as-cast structure. This factor is associated with the diffusion of carbides (in the pearlite, or other product of austenite decomposition, resulting from the reactions taking place in the casting as it cools from the casting temperature) at the "annealing" temperature. This factor is by far the most important when dealing with resistance to hardness breakdown. For most or the irons, this governs the hardness of the iron after "annealing" or drawing at temperatures up to 1400 to 1450 degrees Fahr.
2. The stability of austenite. When the irons are heated above their critical temperature ranges and the matrices become austenitic before the irons are again cooled to room temperature in the furnace (true annealing), the final microstructures depend upon the rates of austenite decomposition at the various temperature levels passed through during cooling.

Few of the irons show much drop in hardness until a temperature of 1100 degrees Fahr. has been attained. Between this temperature and 1400 degrees Fahr. the irons show considerable variation in the slopes of their curves. Except for the iron alloyed with 0.56 per cent chromium, the hardnesses of the irons alloyed with a single element (nickel, molybdenum, vanadium, copper) and even the nickel-molybdenum combination, No. 7, show considerable loss in hardness upon annealing at temperatures between 1100 and 1400 degrees Fahr.

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This is the first of a series of two articles on effect of alloy additions on gray cast iron. The second and concluding article will appear in an early issue.

THE EDITORS.

Big Four Flux Co. formerly located at 1914 Pleasant Run boulevard, Indianapolis, recently has moved to 2164 South Delaware.

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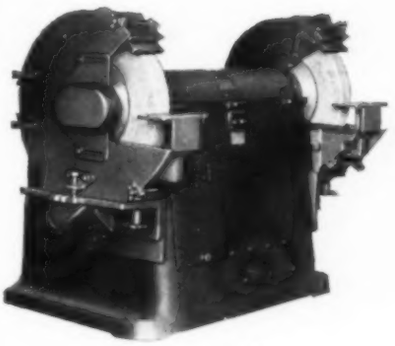

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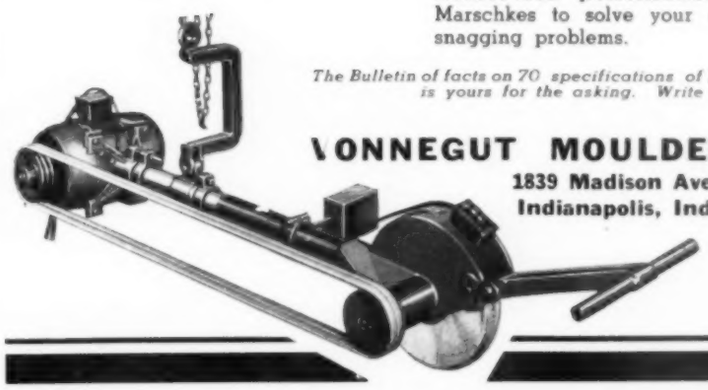

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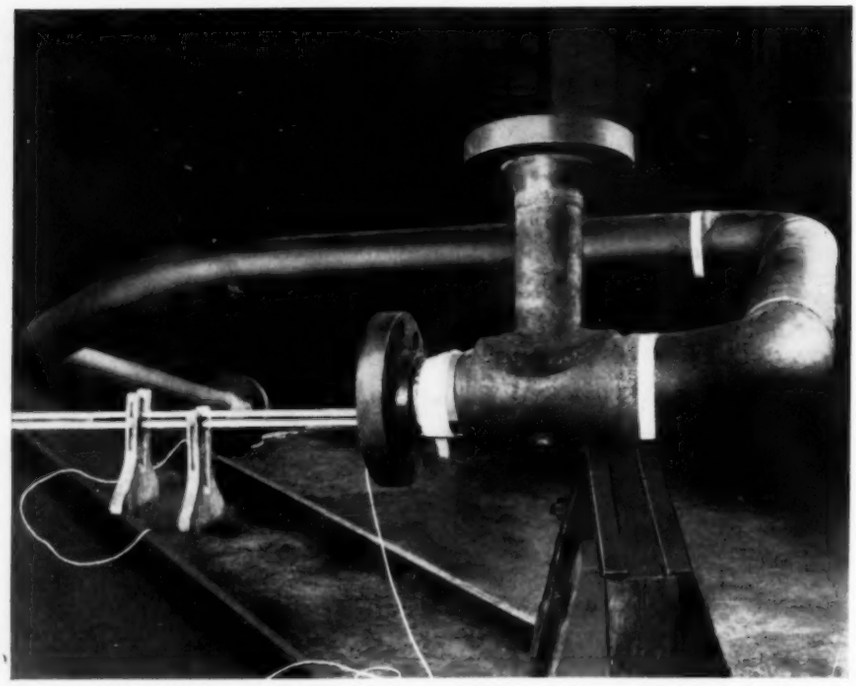

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